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THE UNIVERSITY BULLETINS NINETEENTH SERIES: No. 4—PART 7

# University of Pennsylvania

Founded 1740

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UNIVERSITY OF ILLINOIS

# Announcement of the
# Towne Scientific School

Founded 1875

## 1919-1920

PHILADELPHIA:
Published by the University
April, 1919
BI-MONTHLY

## SPECIAL NOTICE.

Copies of the University Catalogue (containing detailed information concerning all the Schools) may be obtained ONLY upon application to the Secretary of the University, Law School Building.

To any alumnus of the University, the Catalogue will be sent upon application on receipt of name, class, and address.

The special announcement of the following divisions of the University will be sent upon application to the appropriate Dean:

- THE COLLEGE.
- THE TOWNE SCIENTIFIC SCHOOL, including
  - THE COURSES IN ARCHITECTURE.
  - THE COURSE IN CHEMICAL ENGINEERING.
  - THE COURSE IN CHEMISTRY.
  - THE COURSE IN CIVIL ENGINEERING.
  - THE COURSE IN ELECTRICAL ENGINEERING.
  - THE COURSE IN MECHANICAL ENGINEERING.
- THE WHARTON SCHOOL OF FINANCE AND COMMERCE.
- THE SCHOOL OF EDUCATION.
- THE GRADUATE SCHOOL.
- THE LAW SCHOOL.
- THE SCHOOL OF MEDICINE.
- THE SCHOOL OF DENTISTRY.
- THE SCHOOL OF VETERINARY MEDICINE.

*Bi-Monthly*
*Entered at the Philadelphia, Pa., Post-Office as Second Class Matter*

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# University of Pennsylvania

Founded 1740

## Announcement of the

# Towne Scientific School

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# THE UNIVERSITY.

## General Information.

### LOCATION.

The buildings of the University of Pennsylvania are situated in Philadelphia, on property covering an area of over fifty-nine acres. In addition to this land the University has recently acquired from the city an adjoining tract comprising fifty-five acres, more or less. The University may be reached from the various railroad stations as follows: From the West Philadelphia station of the Pennsylvania Railroad, on foot west on Woodland Avenue, a walk of less than ten minutes; from the Philadelphia and Reading Terminal station by the subway, Thirteenth and Market Streets, west to Thirty-fourth Street, by Darby, Angora or Chester cars; or from the Baltimore and Ohio Railroad station by a walk of one square south to Walnut Street, thence by car over the bridge west to Thirty-fourth Street.

### APPLICATIONS FOR CATALOGUES, ETC.

Applications for copies of the annual University Catalogue should be addressed to the Secretary of the University of Pennsylvania, Philadelphia, Pa.

The University also issues announcements relating to the Towne Scientific School and the several Schools or to individual Departments and often containing information not found in the Catalogue. Inquirers interested in special branches of work only are advised to apply for these announcements, not for the Catalogue.

All letters of inquiry regarding the internal regulations and requirements of the Towne Scientific School should be addressed to the Dean, and *not* to the Secretary of the University.

### ACCOMMODATIONS FOR STUDENTS.

Lodging for students to the number of nearly nine hundred is provided in the present dormitory system, which comprises an extended group of contiguous houses fronting upon three open courts.

Plans of the dormitories, prices and other details may be obtained upon application to the Bursar of the University, College Hall.

Board and lodging may be obtained also in the immediate vicinity of the University. Upon application at the office of the Dean, lists of approved boarding houses may be seen.

### HOUSTON HALL.

Houston Hall is the home of the Houston Club, to membership in which any member of the University is eligible. A fee of ten dollars ($10.00) is added to the tuition fee of every student in the Towne Scientific School for the privileges of the Gymnasium and the Houston Club.

The Club is the exponent of the social side of Pennsylvania life. Its purposes are to provide for the students a place where all may meet socially on common ground, and to furnish every available facility for healthy recreation and amusement in leisure hours. The equipment of the Hall includes a library and reading room, with a large number of periodicals and newspapers; smoking rooms, billiard and pool tables, tables for chess and checkers; a correspondence room; bowling alleys, shuffle boards; athletic trophy rooms; a large auditorium with grand organ; rooms for the University papers and other organizations; a post-office "sub-station," barber shop, book and general supply store; a luncheon buffet and dining room; a dark room for amateur photographers and many other rooms for general purposes.

The Christian Association, which has its headquarters in Houston Hall, is prepared to furnish prospective students, through its Secretary, full information with regard to the various undergraduate social activities, both secular and religious.

# UNIVERSITY OF PENNSYLVANIA.

## CHRONOLOGICAL TABLE.

1740—"Charity School" founded.

1749—The "Academy" established, with which the Charity School was combined.

1753—Charter granted by Thomas and Richard Penn, incorporating "The Academy and Charitable School."

1755—"Confirmatory Charter" granted by Thomas and Richard Penn, incorporating "The College, Academy and Charitable School."

1765—School of Medicine founded.

From September, 1777, to June, 1778, owing to the occupation of Philadelphia by British troops, recitations and lectures were suspended.

1779—Withdrawal of the chartered rights and privileges of The College by the State Assembly, and incorporation of the "University of the State of Pennsylvania."

1789—Restoration of its chartered rights and privileges to The College.

1790—Law School founded (re-established in 1850).

1791—Union of the University of the State of Pennsylvania with The College, under the title of the UNIVERSITY OF PENNSYLVANIA.

1874—University Hospital established.

1875—Towne Scientific School founded.

1877—Department of Music established.

1878—School of Dentistry founded.

1881—Wharton School of Finance and Commerce founded.

1882—Graduate School founded.

1884—Veterinary School founded.

1885—Veterinary Hospital established.

1885—Department of Physical Education established.

1889—Department of Archaeology founded.
1892—Laboratory of Hygiene established.
1892—Wistar Institute of Anatomy and Biology established.
1892—Saturday Courses for Teachers established.
1896—Houston Club organized.
1896—Flower Astronomical Observatory opened.
1904—Summer School (College) established.
1906—College Courses for Teachers established.
1910—Henry Phipps Institute transferred to the University.
1912—Division of the College into three departments—The College, the Towne Scientific School, and the Wharton School.
1914—The School of Education established.
1916—Medico-Chirurgical College and Hospital merged with University.
1916—Department of Military Science and Tactics established.

## HISTORICAL SKETCH.

On November 13, 1749, soon after the publication of a pamphlet written by Benjamin Franklin, and entitled "Proposals relating to the Education of Youth in Pensilvania," twenty-four public-spirited citizens of Philadelphia associated themselves for the purpose of establishing an Academy, and "laying a Foundation for Posterity to erect a Seminary of Learning more extensive and suitable to their future Circumstances." One of their first acts was to negotiate for the possession of a building constructed under a trust established in 1740, and intended to be used for a "Charity School" and as a "House of Publick Worship." This building had been used for the second purpose as early as November, 1740, when the celebrated Whitefield first preached in it; but the charity school had never been set in operation. The Trustees, recognizing the opportunity to have the full purpose of their trust carried out, and "in order that said building may at length be applied to the good and pious uses originally intended," conveyed it on February 1, 1750, to the Trustees of the Academy by an Indenture, which bound the latter to place, erect, found, establish, or keep a "House of Publick Worship" and also "one free school for the instruction, teaching and education of poor children or scholars within two years from the date of these presents"; and which further provided that they "shall have full power to found, erect, establish and continue in and upon the said house and premises such other school, Academy, college or other seminary of learning" as should not conflict with the original objects of the elder trust. Under these agreements—which in due time were faithfully fulfilled—the Trustees of the Academy took possession of the "New Building," as it was then called, fitted it up for its enlarged uses, engaged a Rector and subordinate instructors, and formally opened the Academy in the presence of a distinguished company on January 7, 1751. So successful was the undertaking that in 1753 the Trustees secured a Charter for the Academy.

Under the skilful training of the learned Rev. William Smith, the highest class in this Academy attained that proficiency which, in a College course, would entitle it to a Degree. Accordingly, two years later the Proprietaries were again petitioned to convert the Academy into a College with the power of conferring collegiate degrees. The petition was granted.

The First Commencement was held May 17, 1757, when Paul Jackson, Jacob Duché, Francis Hopkinson, Samuel Magaw, Hugh Williamson, James Latta, and John Morgan received the Degree of Bachelor of Arts. In the agitated times that followed, during the wars with the French, the Provost, Mr. Smith, opposed so vehemently the non-resistance policy of the legislature of Pennsylvania, that by an arbitrary stretch of power he was thrown into prison. In faithfulness to his duties as Provost, however, he received his classes in gaol, and continued his instructions to them there while still a prisoner. Finally he was set at liberty, for the purpose of going to England to make a personal appeal to the king, and his kindly reception there was not lessened by the strain to which his loyalty at home had been put. Oxford conferred on him the Degree of Doctor of Divinity. On his return home so highly did his fellow-citizens rate his influence abroad, that when in 1761 the Trustees were hard bestead, they sent him back to England to raise funds for an endowment. It happened that King's College (now Columbia) in New York was in similar straits, and had resolved on similar efforts. The two commissioners met in England and amicably resolved to "divide the land between them" and share the proceeds. Through the influence of the Archbishop of Canterbury they received a circular letter from the king to all the churches, and succeeded in raising a very considerable endowment for each college.

On Dr. Smith's return, as it appears on the minutes of the 14th of June, 1764, a letter was received from the Archbishop of Canterbury, Thomas and Richard Penn, and the Rev. Samuel Chandler, D.D., addressed to the Trustees, in which the Trustees are congratulated on the success of Dr. Smith's, the Provost's, collection in England, and advised of what would be further necessary to the due improvement of the collection and the future prosperity of the institution. "That the institution was originally founded and carried on for the general benefit of a mixed body of people—that on the king's brief it is represented as a seminary that would be of great use for securing capable instructors and teachers as well for the service of the society for propagating the gospel in foreign parts, as for other protestant denominations in the colonies.—That at the time of making the collection, the Provost was a clergyman of the Church of England—the Vice-Provost, a Presbyterian—a principal professor, a Baptist, with other useful professors and tutors, all carrying on the education of youth with great harmony, and people of various denominations have heretofore contributed liberally and fully.—That jealousies had arisen lest the foundation should be narrowed, and some party exclude the rest, or put them on a worse footing than they have been or were at the time of the collection, which would be unjust and productive of contentions unfriendly to religion." It was therefore recommended to the Trustees, by the writers of the letter (who had a principal share in procuring the collection), to make a fundamental rule or declaration, to prevent inconvenience of this kind, and in doing which, they were advised that the more closely they kept in view the plan on which the seminary was at the time of the royal brief, and on which it was carried on from the beginning, so much the less cause would any party have to be dissatisfied.

A committee having been appointed to frame a fundamental *Resolve* or declaration, in consequence of the letter, the following was reported and adopted:

"The trustees being ever desirous to promote the peace and prosperity of this seminary, and to give satisfaction to all its worthy benefactors, have taken the above letter into their serious consideration, and perfectly approving the sentiments therein contained, do order the same to be inserted in their books, that it may remain perpetually *declaratory* of the present wide and excellent plan of this institution, which hath not only met with the approbation of the great and worthy personages above mentioned, but even the royal patronage of his majesty himself. They further *declare* that they will keep this plan closely in their view, and use their *utmost endeavors* that the same *be not narrowed,* nor the members of the church of England, or those dissenting from them (*in any future election to the principal offices mentioned in the aforesaid letter*), be put on *any worse footing* in this seminary, than they were *at the time of obtaining the royal brief.* They subscribe this with their names, and ordain that the same be read and subscribed by every new trustee that shall hereafter be elected, before he takes his seat at the board."

Perhaps no more striking instance can be given of the distortion to which men's minds were subject in those days of political commotion, than the fact that in 1779 this resolution was construed by the legislature into a "narrowing of the foundation," and seized as a pretext for confiscating all the rights and properties of the College, which were bestowed upon a new organization called in its charter the "Trustees of the University of the State of Pennsylvania." Ten years later, these rights and properties were all restored, and in 1791 an act was passed amalgamating the old College with the new University, under the title of the University of Pennsylvania.

## DIVISIONS.

The University of Pennsylvania comprehends the following divisions:

- THE COLLEGE, including
  - THE SUMMER SCHOOL COURSES.
- THE TOWNE SCIENTIFIC SCHOOL, including
  - THE COURSES IN ARCHITECTURE.
  - THE COURSE IN CHEMICAL ENGINEERING.
  - THE COURSE IN CHEMISTRY.
  - THE COURSE IN CIVIL ENGINEERING.
  - THE COURSE IN ELECTRICAL ENGINEERING.
  - THE COURSE IN MECHANICAL ENGINEERING.
- THE WHARTON SCHOOL, including
  - THE EVENING SCHOOL.
- THE SCHOOL OF EDUCATION.
- THE GRADUATE SCHOOL.
- THE LAW SCHOOL.
- THE SCHOOL OF MEDICINE.
- THE SCHOOL OF DENTISTRY.
- THE SCHOOL OF VETERINARY MEDICINE AND HOSPITAL.
- THE UNIVERSITY HOSPITAL.
- THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY.
- THE LABORATORY OF HYGIENE.
- THE UNIVERSITY LIBRARY.
- THE UNIVERSITY MUSEUM.
- THE FLOWER ASTRONOMICAL OBSERVATORY.
- THE DEPARTMENT OF PHYSICAL EDUCATION.
- PSYCHOLOGICAL CLINIC.
- HENRY PHIPPS INSTITUTE.
- THE DEPARTMENT OF MILITARY SCIENCE AND TACTICS.

**PROVOST:**

EDGAR FAHS SMITH, Ph.D., Chem.D., ScD., L.H.D., Litt.D., LL.D.
President *pro tempore* of the Trustees.

**VICE-PROVOST:**

JOSIAH HARMAR PENNIMAN, Ph.D., LL.D.

## CORPORATION.

### THE TRUSTEES OF THE UNIVERSITY OF PENNSYLVANIA.

THE GOVERNOR OF PENNSYLVANIA: President *ex-officio*.

ELECTED.
1876. CHARLES CUSTIS HARRISON, LL.D.
1880. WHARTON BARKER.
1896. MORRIS JAMES LEWIS, Ph.D., M.D.
1896. RANDAL MORGAN.
1898. SAMUEL FREDERIC HOUSTON.
1901. JOSEPH LEVERING JONES, LL.D.
1903. ROBERT GRIER Le CONTE, M.D.
1903. JOSHUA BERTRAM LIPPINCOTT.
1905. ARTHUR LATHAM CHURCH
1906. GEORGE HARRISON FRAZIER.
1910. JOHN CADWALADER, LL.D.
1910. CHARLES LOUIS BORIE, Jr.
1910. LOUIS CHILDS MADEIRA.
1911. EDWARD TOWNSEND STOTESBURY.
1911. EFFINGHAM BUCKLEY MORRIS.
1911. GEORGE WHARTON PEPPER, D.C.L., LL.D.
1911. MORRIS LEWIS CLOTHIER, LL.D.
1911. Hon. JOHN CROMWELL BELL, LL.D.
1911. RICHARD ALEX. FULLERTON PENROSE, Jr., Ph.D.
1916. WILLIAM AUGUSTUS REDDING.
1917. HAMPTON LAWRENCE CARSON, LL.D.
1917. DAVID MILNE.

Secretary of the Corporation.
EDWARD ROBINS, A.M.

## 1919

### JANUARY

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### APRIL

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## 1920

### JANUARY

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### FEBRUARY

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### MARCH

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### APRIL

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### JUNE

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# CALENDAR FOR 1918-19, 1919-20

## 1919.

Apr. 16, Wednesday .Easter Recess begins, 6 P. M.

Apr. 22, Tuesday ....Easter Recess ends, 8.30 A. M.

May 5, Monday ....Last day for receipt of Theses, Prize Essays and Reports.

June 2, Monday ....Final Examinations, 9 A. M.

June 15, Sunday .....Graduation Sermon.

June 18, Wednesday..Commencement.

June 16 to June 21...Entrance Examinations. These examinations are given by the College Entrance Examination Board at many centers throughout the United States and Canada. Monday, 9 A. M., to Saturday, 6 P. M.

July 7, Monday ....Summer School Session begins, 9 A. M.

Aug. 16, Saturday ....Summer School Session ends, 6 P. M.

SUMMER RECESS.

Sept. 6, Saturday ...Last day to register for September entrance examinations without paying the extra fee.

Sept. 11, Thursday ...Last day for filing application for admission to the first term, without paying the late application fee.

Sept. 15 to Sept. 20....Entrance Examinations. Monday, 9 A. M., to Saturday, 6 P. M.

Sept. 15 to Sept. 20....Re-examination of Conditioned Students. Monday, 9 A. M., to Saturday, 6 P. M.

Sept. 23, 24, 25 ........Registration and Advising of Students.

Sept. 26, Friday .....Session begins.

Nov. 26, Wednesday .Thanksgiving Recess begins, 6 P. M.

Dec. 1, Monday ....Thanksgiving Recess ends, 8.30 A. M.

Dec. 20, Saturday ....Christmas Recess begins, 6 P. M.

## 1920.

Jan. 5, Monday ....Christmas Recess ends, 8.30 A. M.

Jan. 26 to Feb. 7 ......Entrance Examinations. Monday, 7 P. M., to Saturday, 5 P. M.

Jan. 26, Monday ....Mid-Year Examinations, 9 A. M.

Feb. 2, Monday ....Re-examination of Students conditioned in Second Term Courses, 9 A. M.

Feb. 9, Monday ....Second Term begins, 8.30 A. M.

Feb. 23, Monday ....University Day. Recess in all Departments.

Mar. 31, Wednesday .Easter Recess begins, 6 P. M.

Apr. 8, Thursday ...Easter Recess ends, 8.30 A. M.

May 3, Monday ....Last day for receipt of Theses, Prize Essays and Reports.

May 31, Monday ....Final Examinations, 9 A. M.

June 13, Sunday ....Graduation Sermon.

June 16, Wednesday .Commencement.

June 21 to 26 ........Entrance Examinations. These examinations are given by the College Entrance Examination Board at many centers throughout the United States and Canada. Monday, 9 A. M., to Saturday, 6 P. M.

July 5, Monday ....Summer School Session begins, 9 A. M.

Aug. 14, Saturday ....Summer School Session ends, 6 P. M.

SUMMER RECESS.

Sept. 4, Saturday ...Last day to register for the September entrance examinations without paying the extra fee.

Sept. 9, Thursday ...Last day for filing applications for admission to the first term without paying the late application fee.

Sept. 13 to Sept. 18. .Entrance Examinations. Monday, 9 A. M., to Saturday, 6 P. M.

Sept. 13 to Sept. 18 ....Re-examinations of Conditioned Students. Monday, 9 A. M., to Saturday, 6 P. M.

Sept. 21, 22, 23 .......Registration and Advising of Students.

Sept. 24, Friday .. ..Session begins.

## ADMINISTRATIVE OFFICERS.

### OF THE CORPORATION.

*Provost*—EDGAR F. SMITH, PH.D., CHEM.D., SC.D., L.H.D., LITT.D., LL.D.

Office in the John Harrison Laboratory of Chemistry, Thirty-fourth and Spruce Streets.

*Vice-Provost*—JOSIAH H. PENNIMAN, PH.D., LL.D.

Office, 104 College Hall.

*Secretary*—EDWARD ROBINS, A.M.

Office, 4 Law School Building.

*Treasurer pro tempore*—SAMUEL F. HOUSTON.

Office, 400 Chestnut Street.

*Recorder*—GEORGE E. NITZSCHE, LL.B.

Office, Houston Hall.

*Bursar*—WILLIAM O. MILLER, A.B.

Office, 102 College Hall. Office hours, 9 A. M. to 5 P. M., daily.

The Bursar's office is open from 8.45 A. M. to 5 P. M. Saturdays, 8.45 A. M. to 1 P. M.

### OF THE TOWNE SCIENTIFIC SCHOOL.

*Dean of the Towne Scientific School Faculty*—HENRY BROWN EVANS, M.E., PH.D.

Office, Engineering Building. Office hours, 9 A. M. to 12 M. daily.

### OF THE DEPARTMENT OF PHYSICAL EDUCATION.

*Director*—R. TAIT MCKENZIE, A.B., M.D.

Office in the Gymnasium, Thirty-third and Spruce Streets. Office hours, 3 P. M. to 6 P. M., daily except Saturdays.

*Students' Physicians*—The Trustees have appointed DRS. GEORGE WILSON and FRANCIS G. HARRISON to act as students' physicians, under the guidance of the Physician-in-Chief of the Medical Dispensary of the University Hospital. A Students' Dispensary is conducted daily at the University Hospital.

*Ophthalmologist*—WILLIAM C. POSEY, A.B., M.D., 2049 Chestnut Street.

Office hours, from 8.30 A. M. to 1 P. M., daily. Telephone connection.

# THE TOWNE SCIENTIFIC SCHOOL.

## FACULTY.

EDGAR F. SMITH, Ph.D., Chem.D., Sc.D., L.H.D., Litt.D., LL.D., Provost and blanchard Professor of Chemistry.

JOSIAH H. PENNIMAN, Ph.D., LL.D., Vice-Provost, and Professor of English Literature.

HENRY B. EVANS, M.E., Ph.D., Dean of the Towne Scientific School, and Professor of Mathematics.

FELIX E. SCHELLING, A.M., Ph.D., Litt.D., LL.D., john welsh centennial Professor of History and English Literature.

ARTHUR W. GOODSPEED, Ph.D., Professor of Physics, and Director of the Randal Morgan Laboratory of Physics.

EDWIN S. CRAWLEY, Ph.D., thomas a. scott Professor of Mathematics.

GEORGE E. FISHER, A.M., Ph.D., Professor of Mathematics.

WARREN P. LAIRD, Sc.D., Professor of Architecture.

HUGO ALBERT RENNERT, Ph.D., LL.D., Professor of Romanic Languages and Literature.

HERBERT E. EVERETT, Professor of the History of Art.

WILLIAM R. NEWBOLD, Ph.D., adam seybert Professor of Intellectual and Moral Philosophy.

*ALEXANDER C. ABBOTT, M.D., Dr.P.H., Sc.D., Professor of Hygiene and Bacteriology.

ISAAC J. SCHWATT, Ph.D., Professor of Mathematics.

DANIEL B. SHUMWAY, Ph.D., Professor of German Philology.

WILLIAM EASBY, Jr., C.E., Professor of Municipal Engineering.

EDGAR A. SINGER, Jr., Ph.D., Professor of Philosophy.

CLARENCE G. CHILD, A.M., Ph.D., L.H.D., LL.D., Professor of English Literature.

J. VERNE STANFORD, B.S., M.E., Professor of Mechanical Engineering.

DAVID H. BERGEY, A.M., M.D., Assistant Professor of Bacteriology.

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*Absent on leave.

PAUL P. CRET, Arch. Diplomé du Gouvernment Français, O.A., Sc.D., Professor of Design.

EDWARD C. WESSELHOEFT, A.M., Professor of German.

HORACE C. RICHARDS, Ph.D., Professor of Mathematical Physics.

GEORGE H. HALLETT, A.M., Ph.D., Professor of Mathematics.

ARTHUR H. QUINN, Ph.D., Professor of English and Dean of the College Faculty.

ERIC DOOLITTLE, C.E., FLOWER Professor of Astronomy.

CORNELIUS WEYGANDT, Ph.D., Professor of English Literature.

GEORGE W. DAWSON, Professor of Drawing.

THOMAS NOLAN, Ph.B., M.S., A.M., Professor of Architectural Construction.

ARTHUR C. HOWLAND, Ph.D., Professor of Medieval History.

R. TAIT McKENZIE, A.B., M.P.E., M.D., Professor of Physical Education, Director of the Department of Physical Education.

OWEN L. SHINN, Ph.D., Professor of Applied Chemistry.

WALTER T. TAGGART, Ph.D., Professor of Organic Chemistry.

JOHN J. MORRIS, Professor of Mechanical Constructive Practice.

FREDERICK EHRENFELD, Ph.D., Assistant Professor of Geology and Mineralogy.

HORACE P. FRY, B.S. in E.E., Assistant Professor of Mechanical Drawing.

EDWARD L. INGRAM, C.E., Professor of Railroad Engineering and Geodesy.

FREDERICK H. SAFFORD, A.M., Ph.D., Assistant Professor of Mathematics.

HERMAN C. BERRY, A.B., B.S. in C.E., Professor of Materials of Construction.

WILLIAM C. H. SLAGLE, C.E., Sc.D., Assistant Professor of Descriptive Geometry and Drawing.

ALFRED H. GUMAER, B.S. in Arch., Assistant Professor of Architectural History.

HAROLD C. BARKER, A.M., Ph.D., Assistant Professor of Physics.

PHILIP R. WHITNEY, B.S. in Arch., Assistant Professor of Graphics.

THOMAS P. McCUTCHEON, Jr., Ph.D., Assistant Professor of Chemistry.

MAURICE J. BABB, Ph.D., Assistant Professor of Mathematics.

THOMAS D. O'BOLGER, A.M., Ph.D., Assistant Professor of English.

GEORGE G. CHAMBERS, Ph.D., Assistant Professor of Mathematics, and Director of Admissions.

OLIVER E. GLENN, A.M., Ph.D., Professor of Mathematics.

JOHN FRAZER, A.M., Ph.D., Assistant Professor of Chemistry.

*LEON ARNAL, A.D.G.F., Assistant Professor of Design.

WILLIAM S. PARDOE, B.A.Sc., Assistant Professor of Civil Engineering.

EDWARD T. GRANDLIENARD, C.E., Assistant Professor of Civil Engineering.

*J. P. WICKERSHAM CRAWFORD, Ph.D., Professor of Romanic Languages and Literatures.

ROBERT H. FERNALD, M.E., A.M., Ph.D., Whitney Professor of Dynamical Engineering.

THOMAS D. COPE, A.B., Ph.D., Assistant Professor of Physics.

HIRAM S. LUKENS, Ph.D., Assistant Professor of Chemistry.

SAMUEL G. BARTON, Ph. D., Assistant Professor of Astronomy.

HOWARD H. MITCHELL, Ph.B., Ph.D., Assistant Professor of Mathematics.

MELVIN R. HARKINS, A.B., Ph.D., Assistant Professor of Physics.

DICRAN H. KABAKJIAN, M.S., Ph.D., Assistant Professor of Physics.

PERCY V. D. SHELLY, A.M., Ph.D., Assistant Professor of English.

GEORGE H. BICKLEY, B.S. in Arch., A.D.G.F., Assistant Professor of Design.

HAROLD PENDER, Ph.D., Professor of Electrical Engineering.

C. E. CLEWELL, E.E., Assistant Professor of Electrical Engineering.

JOSEPH SERONDE, M.A., Ph.D., Assistant Professor of French.

DANIEL E. OWEN, A.M., Ph.D., Assistant Professor of English.

HERBERT H. VAUGHAN, Ph.D., Assistant Professor of Romanic Languages and Literature.

ERNEST M. PATTERSON, A.M., Ph.D., Assistant Professor of Economics.

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*Absent on leave.

ROBERT L. MOORE, B.S., A.M., Ph.D., Assistant Professor of Mathematics.

WILLIAM H. KAVANAUGH, M. E., Professor of Experimental Engineering.

JOHN WYNKOOP, B.S., Acting Professor of Design.

SENECA EGBERT, A.M., M.D., Professor of Hygiene.

JESSE B. STRAW, B.S. in E. E., Assistant Professor of Electrical Engineering.

GEORGE E. CROFOOT, B.S. in M.E., Assistant Professor of Mechanical Engineering.

GEORGE W. McCLELLAND, A.M., Ph.D., Assistant Professor of English.

AMANDUS JOHNSON, A.M., Ph.D., Assistant Professor of Scandinavian Languages.

*HERBERT S. HARNED, Ph.D., Assistant Professor of Chemistry.

CHARLES T. GRIFFITH, Major, Field Artillery, U. S. A., Professor of Military Science and Tactics.

BENJAMIN F. SCHAPPELLE, A.M., Ph.D., Assistant Professor of Romanic Languages.

ALBERT F. HURLBURT, A.M., Assistant Professor of Romanic Languages.

DANIEL L. WALLACE, Dr. in Chemistry, Instructor in Analytical Chemistry.

EDWIN M. FOGEL, Ph.D., Instructor in German.

JOHN F. MURPHY, Instructor in Foundry Work.

PERCIVAL R. HALL, Instructor in Iron Working.

GEORGE W. H. FAWKES, Instructor in Wood Working.

CHARLES W. BLOEMKER, Instructor in Forging.

JOHN C. MENDENHALL, A.M., Instructor in English.

STANLEY P. SHUGERT, A.M., Ph.D., Instructor in Mathematics.

WILLIAM I. BOOK, B.S., Ph.D., Instructor in Physics.

JOSEPH R. FITZPATRICK, A.M., Instructor in Chemistry.

ROBERT R. McGOODWIN, M.S. in Arch., Instructor in Design.

C. LAURENCE WARWICK, B.S. in C.E., Instructor in Civil Engineering.

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*Absent on leave.

JOHN H. MÜLLER, M.S., A.M., PH.D., Instructor in Chemistry.
WILLIAM T. LEGGO, C.E., Instructor in Civil Engineering.
*JOHN F. HARBESON, B.S., M.S. in Arch., Assistant in Design.
GEORGE B. WHAREN, B.S. in M.E., M.E., Instructor in Mechanical Engineering.
W. CLINTON DU VALL, B.S. in E.E., Instructor in Electrical Engineering.
NORMAN J. BRUMBAUGH, A.M., Instructor in Chemistry.
JOHN LEEDS BARROLL, JR., B.S., A.M., Instructor in English.
CLEMENT VOLLMER, A.B., PH.D., Instructor in German.
WILLIAM P. HARBESON, B.S., LL.B., Instructor in English.
KARL H. FUSSLER, A.B., PH.D., Instructor in Physics.
JOHN DOLMAN, JR., B.S., A.M., Instructor in English and Forensics.
JAMES B. LICHTENBERGER, A.B., LL.B., Lecturer on Business Law.
FRANK A. LAURIE, JR., B.S., A.M., Instructor in English.
RALPH W. DUNCAN, PH.D., Instructor in Physics.
PAUL C. KITCHEN, PH.D., Instructor in English.
FRANCIS R. BACON, B.S. in Arch., Instructor in Architecture.
J. HORACE FRANK, B.S. in Arch., Instructor in Charge of Night Work in Architecture.
ALBERT C. BAUGH, A.M., PH.D., Instructor in English.
MIGUEL ROMERA-NAVARRO, A.B., M.L., Instructor in Spanish.
MATTHEW W. BLACK, A.M., Instructor in English.
WALTER C. SETZER, Assistant in Mechanical Engineering.
PAUL H. MUSSER, A.B., Instructor in English.
RICHARD E. BROWN, E.E., M.M.E., Instructor in Electrical Engineering.
WILLIAM A. SLOAN, B.S. in M.E., Instructor in Mechanical Engineering.
HAROLD S. STINE, A.B., Instructor in English.
KARL W. H. SCHOLZ, A.M., PH.D., Instructor in German.
ALLAN L. CARTER, A.M., Instructor in German.
EMILE MALAKIS, A.B., Instructor in French.
ALVIN C. BIEBER, Reader in Architecture.
GERALD A. ANDERSON, Assistant in Architecture.

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*Absent on leave.

GEORGE W. BIRCH, B.S. in Ch., Instructor in Chemistry.
WILLIAM CLEVER, Assistant in Civil Engineering.
GEORGE F. COLE, A.B., A.M., Instructor in French.
ISAAC C. CORNOG, A.B., Instructor in Physics.
MORRILL T. DOW, B.S., Instructor in Physics.
CHARLES E. GREEN, A.B., A.M., Instructor in Spanish.
J. CRAIG JANNEY, Assistant in Architecture.
JOHN C. KARCHER, A.B., Instructor in Physics.
EUGENE KOHN, B.S. in Ch. E., Instructor in Chemistry.
J. TRACEY LAY, B.S., Instructor in Chemistry.
RALPH MAIR, B.S. in Ch. E., Instructor in Chemistry.
RAYMOND MORGAN, A.M., Instructor in Physics.
BARTRAM A. OWEN, B.S. in C.E., Instructor in Civil Engineering.
JOHN P. ROBERTS, Reader in Architecture.
HARRY SELTZ, B.S. in Ch. E., Instructor in Chemistry.
CLARENCE L. SEN, B.S. in Ch. E., Instructor in Chemistry.
PAUL F. TAYLOR, Reader in Architecture.
JOSEPH M. THOMAS, A.B., Instructor in Physics.
ANTON D. UDDEN, A.B., Instructor in Physics.
JUDSON F. VODGES, Jr., B.S. in C.E., Instructor in Civil Engineering.
JOSE deA. COSTA, B.S. in E.E., Instructor in Electrical Engineering.
MATTHIAS A. SHAABER, A.B., Instructor in English.
JOSEPH A. MEREDITH, A.B., M.A., Instructor in Romanic Languages.
LOUIS F. McCABE, A.B., Instructor in Mathematics.
ALEXANDER M. DICKEY, B.S. in C.E., Instructor in Civil Engineering.

## ADMISSION.

Complete information concerning the requirements for admission is given in the Bulletin of Information Concerning Admission. A copy of that bulletin will be sent upon a request addressed to the **Director of Admissions, College Hall, University of Pennsylvania.**

## APPLICATIONS FOR ADMISSION.

Every candidate for admission should file an application in the Office of Admissions on a blank provided for that purpose. Copies of that blank may be obtained by writing to the Director of Admissions, College Hall, University of Pennsylvania, Philadelphia, Pa.

The University will be pleased to receive applications from prospective students two, or even three, years before they expect to begin work at the University.

## LATE APPLICATION FEE.

A fee of five dollars will be charged each applicant whose application, together with the necessary credentials, has not been filed in the Office of Admissions at least two weeks before the opening day of the term during which the applicant desires to begin work at the University. In such cases the fee must be paid before a certificate of admission will be issued, but will not be charged unless the action upon the application is favorable. This fee will not be returned.

If entrance examinations are taken, the necessary credentials for admission to the examinations will be considered as part of the credentials that should be filed before the two weeks' period mentioned in the preceding paragraph.

## ENTRANCE REQUIREMENTS.

To be admitted as a regular student in the Freshman Class a candidate for admission *must* obtain credit as follows:

1. A total of 15 units in acceptable college preparatory subjects. See List of Subjects Acceptable for Admission on page 25.

2. Of the 15 units at least 11½ units must be in subjects in the following list: English, History, Mathematics, Foreign Languages and the Sciences.

3. The 15 units must include the following.

| | | |
|---|---|---|
| English | 3 | units |
| History | 1 | unit |
| A Modern Foreign Language | 2 | units |
| Algebra | 1½ | units |
| Plane Geometry | 1 | unit |
| Solid Geometry | ½ | unit |
| Physics | 1 | unit |

The foreign language must be French, German, Spanish, or Italian. Candidates for admission to the *Course in Architecture,* or the *Course in Architectural Engineering,* are strongly urged to present French.

4. Candidates for admission to the *Courses in Chemistry, Chemical Engineering, Civil Engineering, Electrical Engineering* and *Mechanical Engineering* must also include Plane Trigonometry, ½ unit.

5. Candidates for admission to the *Courses* in *Architecture, Chemistry, Chemical Engineering, Civil Engineering, Electrical Engineering* and *Mechanical Engineering,* who have satisfied the requirements above, with the exception of one or more of the particular subjects mentioned under 3 or 4, may, at the discretion of the University, be admitted to take an *irregular* roster including the missing subjects and as much of the regular freshmen work as can consistently be given to them, together with additional college work, if necessary, to meet the minimum requirement as to the amount of work required of Freshmen. The extent of the irregularities in such rosters will depend upon what subjects are missing and their relation to the regular roster. If the irregularities are serious, it may be impossible to complete the requirements for a degree in four years.

## SUBJECTS ACCEPTED FOR ADMISSION.

The numbers of units indicate respectively the minimum and maximum number that will be accepted.

| | |
|---|---|
| English | 3 to 4 units |
| History and Civil Government | 1 to 4 units |
| Latin | 2 to 4 units |
| Greek | 2 to 3 units |
| French | 2 to 4 units |
| German | 2 to 4 units |
| Spanish | 2 to 3 units |
| Italian | 2 to 3 units |
| Algebra | 1 to 2½ units |
| Geometry | 1 to 1½ units |
| Trigonometry | ½ unit |
| Science, including Physics, Chemistry, Biology, Botany, Zoölogy, Physical Geography and Physiology. | |
| Miscellaneous Subjects | ½ to 3½ units |

To obtain credit in English, the candidate must have completed the full requirement, as prescribed by the National Conference on Uniform Entrance Requirements in English.

Not more than 3 units of credit in English can be obtained by examination.

Not more than 3 units of credit in History can be obtained by examination.

Laboratory note-books should not be submitted until called for. They should, however, be ready for submission promptly when called for.

Under the head of Miscellaneous Subjects may be included any subject counted by the candidate's secondary school as a part of the requirement for its diploma, provided the Director of Admissions is satisfied that its subject matter has been properly organized for college preparatory work, and that it has been taught by a competent teacher and with suitable equipment. Typewriting, stenography, military training and physical education are not credited at all, and most miscellaneous subjects, such as drawing and manual training, are not credited for more than one unit each.

No subject will be credited for less than ½ unit.

## VACCINATION.

**According to the Regulations of the Bureau of Health of the City of Philadelphia, the University of Pennsylvania is required to refuse admission to any person except upon a certificate signed by a physician stating that such person has been recently vaccinated or that he or she has previously had smallpox. All persons matriculating in the Towne Scientific School will, therefore have to present such a certificate at the time of matriculation and in default of such certificate must be vaccinated. Official forms furnished by the Bureau of Health of the City of Philadelphia can be obtained by applying in person or by messenger at Room 712, City Hall, between the hours of 9 A. M. and 4 P. M., and on Saturdays from 9 A. M. to 12 M., or at the office of the Dean, Engineering Building.**

## SCHOOL RECORDS.

Graduates of *satisfactory* secondary school courses *may* receive credit without examination for the entrance requirements in whole or in part. A statement of the candidate's school record must be sent to the Director of Admissions promptly after the requirements for graduation are completed. Blanks for the submission of school records may be obtained from the Director of Admissions, College Hall, University of Pennsylvania, Philadelphia, Pa.

## ADMISSION OF RECENT STUDENTS OF HIGHER INSTITUTIONS.

An applicant for admission as a regular student, who has recently been a student in an educational institution ranking higher than a secondary school, should file a formal application for admission as required on page 24, and should present complete credentials concerning his work in all educational institutions above the grammar school. This information should be in the form of official statements from his former institutions, and should be accompanied by a letter of honorable dismissal from the last institution attended.

Blanks for the submission of such records and also a blank for the candidate's formal application may be obtained from the Director of Admissions, College Hall, University of Pennsylvania, Philadelphia, Pa.

An attempt will be made in each case to determine a point of time in the candidate's previous work at which he had fully completed the requirements for admission to the Freshman class. Work done after that time will be considered for advanced credit, in so far as it corresponds to the requirement for the degree desired by the candidate.

A student who has done sufficient work elsewhere to enable him to complete in one year the work required for the Bachelor's degree, in the course which he proposes to enter, may be admitted to the Senior Class, but no student so admitted will be given a degree until at least twelve units (year hours) of work have been satisfactorily completed at the University.

No student may be admitted as a candidate for a degree after the beginning of the Senior year of the class with which he would graduate.

## ADMISSION OF PARTIAL STUDENTS.

A Partial Student is one who, under certain conditions, is permitted to pursue such individual subjects as he is competent to take. Such a student will be subject to the same restrictions in regard to the minimum and maximum amounts of work, as are applicable to regular students.

Every applicant for admission as a Partial Student is required to file an application for admission, as required on page 24, and to present credentials giving a complete record of his scholastic work. He may also be asked to have testimonial letters filed concerning the character of his occupation during the time since he was in school or college.

There are some departments of the Towne Scientific School to which Partial Students are not admitted.

All communications regarding admission as Partial Students should be addressed to the Director of Admissions, College Hall, University of Pennsylvania, Philadelphia, Pa.

## ADMISSION TO THE SPECIAL COURSE IN ARCHITECTURE.

A candidate for admission to the two-year Special Course in Architecture must have spent at least two years at work in the office of a practicing architect; or must have had such other technical training as may, in the judgment of the professor of architecture, be considered as equivalent. If he is less than 21 years of age, he must also satisfy the entrance requirements as given under paragraphs 1, 2 and 3 on page 24, and even if he is over 21 years of age, he may be required to take certain entrance examinations, the particular examinations to be determined in each individual case.

Applications for admission to this course should be sent to the Director of Admissions, College Hall, University of Pennsylvania.

## ADMISSION TO THE GRADUATE COURSE IN ARCHITECTURE.

This course is arranged primarily for the holder of a Bachelor's Degree in Architecture equivalent to that of the University of

Pennsylvania, but other persons, if qualified, may be admitted to its subjects of study.

Applications for admission to this course should be sent to the Director of Admissions, College Hall, University of Pennsylvania.

## ENTRANCE EXAMINATIONS.

Candidates for admission may plan to meet the entrance requirements entirely by examination. Also candidates who can not be given full credit for admission without examination as explained on the preceding pages may complete the entrance requirements by passing examinations.

The University gives two series of entrance examinations each year. For a roster of the next examinations, see page 33.

**The University does not give a series of entrance examinations in June. Candidates desiring examinations in June should take the examinations given by the College Entrance Examination Board. For information concerning the examinations of the Board, see page 35.**

Candidates may take any of the regular examinations held not more than two years and four months in advance of their admission to the University, to satisfy any portion of the subjects required for admission to the course they propose to enter.

## APPLICATIONS FOR EXAMINATIONS.

**In addition to the general application for admission, required of all candidates (see page 24), each candidate desiring to take entrance examinations must file a separate application for each series of examinations desired.**

**Also credentials must be submitted showing that the candidate is prepared to take the particular examinations which he desires. These credentials may come from a school or from a private tutor.**

**If the candidate has been in a school within the year preceding the date of the examination, the credentials must be endorsed by the school, or they must be accompanied by a certificate of graduation or a letter of honorable dismissal.**

For examinations in June, the application should be made directly to the College Entrance Examination Board, and not to the University. Attention is called, however, to the necessity of a certificate of recommendation as required on page 35.

## EXAMINATION FEES.

A fee of five dollars will be charged for each series of entrance examinations taken under the auspices of the University; and an extra fee of five dollars will also be charged, if the application for admission to the desired series of examinations, together with the candidate's general application and the necessary credentials, is not filed in the Office of Admissions at least one week before the beginning of the series. These fees must be paid before the examinations are taken.

If the candidate, after filing his application and paying his fee, withdraws his application and requests the return of his fee, it will be returned, if the request is received at least one week before the beginning of the examination series.

If the credentials for admission to the series of examinations immediately preceding the opening of the term during which the applicant desires to begin work at the University are not filed before the date mentioned in connection with the general application, page 24, a third fee will be charged before a certificate of admission is issued.

The fee may accompany the application, or may be paid in person or by mail any time between the filing of the application and the day of the first examination desired by the candidate. Payment should be in cash, or by bank draft, certified cheque or postal money order, made payable to the University of Pennsylvania.

## LIST OF EXAMINATIONS.

The University gives entrance examinations in the following subjects. More complete descriptions of the scope of these examinations is given in the Bulletin on Information Concerning Admission.

| Subjects | Units |
|---|---|
| English A—Grammar and Composition | 1½ |
| English B—General and Specific Reading | 1½ |

To be admitted to English B the candidate must present evidence that he has done the required reading.

| Subjects | Units |
|---|---|
| History A—Ancient | 1 |
| History B—Medieval and Modern | 1 |
| History C—English | 1 |
| History D—American History and Civil Government | 1 |
| Civil Government | ½ or 1 |

Not more than 3 units of credit in History can be obtained by examination.

The examinations in History D and Civil Government will together count only 1½ units.

| Subjects | Units |
|---|---|
| Latin A—Grammar and Elementary Prose Composition | 2 |
| Latin B—Easy Prose | 2 |
| Latin C—Cicero and Advanced Sight Translation of Prose | 1 |
| Latin D—Virgil and Sight Translation of Poetry | 1 |

Latin B has no value unless offered alone.

Latin A has no value unless offered with Latin C or Latin D.

Latin C has no value unless offered with Latin A.

Latin D has no value unless offered with Latin A.

| Subjects | Units |
|---|---|
| Greek A—Grammar, Composition and Xenophon's Anabasis, | 2 |
| Greek B—Homer's Iliad and Sight Translation | 1 |
| French A—Elementary French | 2 |
| French B—Intermediate French | 1 |
| French C—Advanced French | 1 |
| German A—Elementary German | 2 |
| German B—Intermediate German | 1 |
| German C—Advanced German | 1 |
| Spanish A—Elementary Spanish | 2 |
| Spanish B—Intermediate Spanish | 1 |
| Italian A—Elementary Italian | 2 |
| Italian B—Intermediate Italian | 1 |
| Mathematics A—Elementary Algebra | 2 |
| Mathematics G—Elementary Algebra (Minor Requirement) | 1 |
| Mathematics B—Higher Algebra | ½ |
| Mathematics C—Plane Geometry | 1 |
| Mathematics D—Solid Geometry | ½ |
| Mathematics F—Plane Trigonometry | ½ |
| Physics | 1 |

| Subjects | Units |
|---|---|
| Chemistry | I |
| Biology | I |
| Botany | I |
| Zoölogy | I |
| Physical Geography or Physiography | ½ or I |
| Physiology | ½ |
| Economics | ½ or I |
| Business Law | ½ or I |
| Commercial Geography | ½ or I |
| Drawing | I |
| Manual Training | I |
| Astronomy | I |

# ROSTER OF ENTRANCE EXAMINATIONS.

## SEPTEMBER, 1919.

| | Beginning at 9 A. M. | Beginning at 2 P. M. | Beginning at 7 P. M. |
|---|---|---|---|
| Monday, Sept. 15 | English **A** (2 hours)<br>English **B** (2 hours) | Physics (2 hours)<br>Chemistry (2 hours) | |
| Tuesday, Sept. 16 | Latin **A** (2 hours)<br>Latin **C** (2 hours) | French **A** (2 hours)<br>French **B** (2 hours) | Latin **B** (2 hours)<br>Latin **D** (2 hours)<br>Both of these examinations should not be taken by the same student. |
| Wednesday, Sept. 17 | Mathematics **A** (3 hours)<br>Mathematics **A2** (2 hours)<br>Mathematics **G** (2 hours)<br>The same student should take only one of these examinations. | German **A** (2 hours)<br>German **B** (2 hours) | Mathematics **C** (2 hours) |
| Thursday, Sept. 18 | History **A** (2 hours)<br>History **B** (2 hours) | History **C** (2 hours)<br>History **D** (2 hours) | Greek **A** (2 hours)<br>Greek **B** (2 hours) |
| Friday, Sept. 19 | Biology (2 hours)<br>Zoölogy (2 hours)<br>Physiology (2 hours)<br>The same student should not take both Zoölogy and Biology. | Mathematics **D** (2 hours)<br>Mathematics **F** (2 hours) | Spanish **A** (2 hours) |
| Saturday, Sept. 20 | Botany (2 hours) | | |
| Monday, Sept. 22 | Civil Gov. (2 hours) | Phys. Geog. (2 hours)<br>Economics (2 hours) | |

| | Beginning at 9 A. M. | Beginning at 2 P. M. | Beginning at 7 P. M. |
|---|---|---|---|
| Tuesday, Sept. 23 | Freehand Draw'g (2 hours) | Mech. Draw'g (2 hours)<br>Manual Tr'ng (2 hours) | |
| Wednesday, Sept. 24 | Business Law (2 hours)<br>Com. Geog. (2 hours) | Italian A (2 hours)<br>Italian B (2 hours) | |

## JANUARY AND FEBRUARY, 1920.

| | | | |
|---|---|---|---|
| Monday, Jan. 26 | | English A (2 hours)<br>English B (2 hours) | |
| Tuesday, Jan. 27 | | Latin A (2 hours)<br>Latin C (2 hours) | Latin B (2 hours)<br>Latin D (2 hours)<br>Both of these examinations should not be taken by the same student. |
| Wednesday, Jan. 28 | Phys. Geog. (2 hours)<br>Economics (2 hours) | Mathematics A (3 hours)<br>Mathm'tics A2 (2 hours)<br>Mathematics G (2 hours)<br>The same student should take only one of these examinations. | Mathematics C (2 hours) |
| Thursday, Jan. 29 | Civil Gov. (2 hours) | History A (2 hours)<br>History B (2 hours) | Greek A (2 hours)<br>Greek B (2 hours) |

| | Beginning at 9 A. M. | Beginning at 2 P. M. | Beginning at 7 P. M. |
|---|---|---|---|
| Friday, Jan. 30. | Freehand Draw'g (2 hours) | Biology (2 hours)<br>Zoölogy (2 hours)<br>Physiology (2 hours) | Spanish **A** (2 hours) |
| | | The same student should not take both Zoölogy and Biology. | |
| Saturday, Jan. 31 | Botany (2 hours) | | |
| Monday, Feb. 2 | Business Law (2 hours)<br>Com. Geog. (2 hours) | Physics (2 hours)<br>Chemistry (2 hours) | |
| Tuesday, Feb. 3 | Mechan. Draw'g (2 hours)<br>Manual Train'g (2 hours) | French **A** (2 hours)<br>French **B** (2 hours) | |
| Wednesday, Feb. 4 | Italian **A** (2 hours)<br>Italian **B** (2 hours) | German **A** (2 hours)<br>German **B** (2 hours) | |
| Thursday, Feb. 5 | | History **C** (2 hours)<br>History **D** (2 hours) | |
| Friday, Feb. 6 | | Mathematics **D** (2 hours)<br>Mathematics **F** (2 hours) | |

Candidates should report at least five minutes before the time announced for the beginning of the examination. Under no circumstances will the time allowed to a candidate be greater than that assigned to the examination in the printed schedule.

Unless an exception is specifically mentioned in the schedule above, the same student may take, during any particular period, both the examinations scheduled for the period. In that case he will have the announced amount of time for each, but he must hand in his book for the first examination before starting the second.

## COLLEGE ENTRANCE EXAMINATION BOARD.

### EXAMINATIONS, JUNE 16-21, 1919.

In June, 1919, there will be separate blank forms for the "application for examination" and "certificate of recommendation". The former should be addressed to the College Entrance Examination Board, 431 West 117th Street, New York, N. Y., the latter to the Director of Admissions, College Hall, University of Pennsylvania, Philadelphia. Both forms may be obtained from the Secretary of the College Entrance Examination Board upon request by mail. The mere consent of a school will not suffice, unless accompanied by a certificate of recommendation from a tutor.

Provided that the application reach the College Entrance Examination Board not later than the date specified below, the examination fee will be $6.00 if the candidate is to be examined in the United States, $20.00 if the candidate is to be examined outside of the United States. The fee should be remitted by postal order, express order, or draft on New York to the College Entrance Examination Board.

Applications and fees of candidates who wish to be examined outside of the United States must reach the Secretary of the Board at least six weeks in advance of the examinations, that is, on or before May 5, 1919.

Applications and fees of candidates who wish to be examined at points in the United States west of the Mississippi River must be received at least four weeks in advance of the examinations, that is, on or before May 19, 1919.

Applications and fees of candidates who wish to be examined at points in the United States east of or on the Mississippi River must be received at least three weeks in advance of the examinations, that is, on or before May 26, 1919.

When the candidate has failed to obtain the required blank form of application for examination, the usual examination fee will be accepted if the fee arrives not later than the specified date accompanied by a memorandum containing the name and address of the candidate, the examination center at which he wishes to present himself, and a list of all subjects in which he may have occasion to take the Board's examinations.

Applications received later than the dates named will be accepted only upon payment of $6.00 in addition to the usual fee.

A list of the places at which the examinations are to be held by the Board in June, 1919, may be obtained on application.

The candidate must also have submitted, directly to the University, teachers' certificates in regard to the required English readings, and in regard to the required laboratory work in the sciences. The Board provides blanks for these certificates. Also such blanks may be obtained directly from the University.

## CLASSIFYING EXAMINATIONS.

Entering students are strongly advised to review those secondary school subjects which they will continue in the University.

Examinations are given in certain subjects which were begun in the secondary school and are to be continued in the University. These examinations are for the purpose of determining what particular work in these subjects the student should take first. Information concerning two of these examinations is given below. Information concerning the others will be announced after regular class work has begun.

English C. This is a classifying examination in English. It is designed to test the student's ability to write English. He will be expected to compose a theme on one of several subjects to be announced, and to rewrite in improved form passages containing common rhetorical errors. The results of this test will be used as a basis for determining the student's needs in his later work.

Every regular student is required to take this examination, unless the desired information has been obtained by the student's having passed an examination in English A (English 1 of the College Entrance Examination Board), or unless he has received advanced credit in Composition of college grade. Likewise every special or partial student is required to take it, if his course at the University is to include English.

It cannot be taken until the entrance requirements have been fully satisfied and a certificate of admission issued.

Students entering the University at the beginning of the year 1919-20 should take this examination at 9 o'clock on Thursday, September 18, or at 9 o'clock on Tuesday, September 23.

Students living near the University are urged to take it on the earlier date mentioned above.

Students who do not take this examination on one of the dates announced will be classed, at least temporarily, as if they had taken the examination and been placed in the lower group.

MATHEMATICS M. This is a classifying examination in Mathematics required of all students entering the engineering courses in the Towne Scientific School, except those who have passed examinations in Mathematics A and F within the year preceding their matriculation and except those who may be given advanced credit in freshman Mathematics (Mathematics 35 and 36). The examination covers elementary algebra and elementary plane trigonometry, and is a test of the student's ability to use the processes of these subjects. Students who fail to pass this examination will be required to take work in these subjects during the first term, and to postpone the regular mathematics of the first term until the second term.

It cannot be taken until the entrance requirements have been fully satisfied and a certificate of admission issued.

Students entering at the beginning of the year 1919-20 should take this examination at 11 o'clock on Tuesday, September 23.

Students who do not take this examination on the date announced will be classed, at least temporarily, as if they had taken the examination and had not passed it.

# GENERAL INFORMATION.

## STATUS AND CLASSIFICATION OF STUDENTS.

### LATE REGISTRATION.

**Students may not register after the second week of a term.**

### REGULAR STUDENT.

A Regular Student is one who has satisfied the Entrance Requirements, and is a candidate for a degree, pursuing his studies in a manner and to the amount prescribed.

### PARTIAL STUDENT.

A Partial Student is one who, under certain conditions, approved by the department concerned, and the Admission Committee, is permitted to pursue such individual subjects as he is competent to take.

A Special or Partial Student who may desire to become a Regular Student, must apply to the Director of Admissions.

**A unit of work is one hour a week for a year in lecture or recitation, or two hours a week for a year in laboratory, drafting room, field, or shop work.**

A student in a course will be advanced to the next higher class if, at the opening of the college year, he has credit in sixty (60) per cent. of the total number of units scheduled in the Catalogue as the work of the preceding class.

A student shall have on his roster a number of hours equivalent to not less than ten (10) units, in addition to the required work in Physical Education.

## FEES AND DEPOSITS.

The amounts noted in the appended schedule are for *Regular and Special Students,* and are for the full academic year. Tuition fees are payable *in advance* in two equal parts; the first on registering for the first term, and the second on February 1. Remittances should be in cash, or by bank draft, certified cheque or postal money order, drawn for the exact amount due, made payable to the University of Pennsylvania, and sent to William O. Miller, Bursar, Room 102, College Hall. For detailed "Regulations Governing Payments," see pages 141 to 144.

| Courses | Amount |
|---|---|
| Architecture | $200 00 |
| Chemical Engineering | 200 00 |
| Chemistry | 200 00 |
| *Civil Engineering | 200 00 |
| Electrical Engineering | 200 00 |
| Mechanical Engineering | 200 00 |

A matriculation fee of five dollars ($5.00) is charged for every new student entering the Towne Scientific School.

### Fee for Gymnasium and Houston Club.

A fee of ten dollars ($10.00) is added to the tuition fee of every student in the Towne Scientific School for the privileges of the Gymnasium and the Houston Club. This fee is payable *in advance* in two equal parts on registering in September and February.

### Fees for Partial Students.

The tuition fees of a Partial student in any course of the Towne Scientific School are twelve dollars and fifty cents ($12.50) for each hour per week per year, or, in the case of laboratory or drawing room work twelve dollars and fifty cents ($12.50) for each two hours per week. The maximum fee required of a Partial student shall, however, in no case exceed in amount the regular tuition fees of the department in which the student is registered.

### Fee for Late Registration.

Students in all departments, who fail to register, or to complete registration by the satisfaction of all term obligations at the Bursar's Office, within two weeks after the opening day of either term of the University, shall be required to pay an additional fee of five dollars ($5.00) for late registration.

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*Students in the Sophomore Class in Civil Engineering will be required to pay a special fee of $10.00 at the beginning of the second term, in connection with the prescribed four-weeks course in Surveying at the end of that term. This fee will be refunded to students who withdraw from the Towne Scientific School before the end of the second term.

### Fee for Special Examinations.

If a special examination or re-examination be taken, a fee of five dollars ($5.00) will be charged, a receipt for which shall be presented to the Instructor holding the examination.

The student must in each case bring a statement showing that he is entitled to such an examination. After this statement has been approved by the Dean the proper charge card will be made out.

### Deposits and Expenses.

Each student on entering the Towne Scientific School is required to make a money deposit to cover loss of books, keys, etc., breakage in the laboratories, damage to University property, and other expenses. Any balance is returned upon graduation or withdrawal from College. The deposit for each course is given in the appended table:

| | |
|---|---|
| Architecture | $10 00 |
| Chemistry | 25 00 |
| Engineering, all courses | 25 00 |

### Graduation and Certificate Fees.

A graduation fee of twenty dollars ($20.00) is charged to each candidate for a baccalaureate degree, and ten dollars ($10.00) to each candidate for the degree of Master of Science in Architecture. A like fee of ten dollars ($10.00) is charged to each candidate for the technical degree of Chemical Engineer, Civil Engineer, Electrical Engineer, or Mechanical Engineer. The fee for Certificate of Proficiency in the Two-Year Special Course in Architecture is ten dollars ($10.00). *No student will be recommended for a degree or certificate until all fees due the University have been paid.*

## BOARD AND LODGING.

Accommodation for students is provided in the Dormitories.* Plans, prices, and all other information relating to the Dormitories may be had upon application to the Bursar. In order to make sure of rooms, students are advised to apply as early as April 1, if possible.

Beginning with the session of 1919-1920 all matriculates in the Freshman Class of the Towne Scientific School who do not reside at home, will be required to live in the University Dormitories, unless excused for cause. Freshmen who may have completed a full year's work at another recognized college will be excused upon request. The houses enclosing the Big Quad, excepting Graduate House, have been set aside as Freshman Dormitories and assignments will be made to prospective residents as soon as they have been certified by the Director of Admissions as eligible.

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*Fuller information in regard to the Dormitories will be found on pages 144-148.

Table board may be had in the immediate vicinity of the University at prices ranging from $5.00 per week upwards. A printed list of approved boarding places, with or without lodging, may be obtained at the Dean's office. The average price paid by students in such quarters for board and lodging is $7.50 per week.

The figures given herewith are based upon the cost of living, either in the dormitories or in a boarding house:

| | Min. | Max. |
|---|---|---|
| Board and lodging—thirty-seven weeks | $250 00 | $450 00 |
| Tuition and other fees | 210 00 | 210 00 |
| Text-books (estimated) | 10 00 | 25 00 |
| Graduation or Certificate Fee | 10 00 | 20 00 |
| | $480 00 | $705 00 |

## DIVISION OF SESSIONS.

The college year is divided into two terms of about eighteen weeks each. The first term begins in 1919 on September 26,† at 10 o'clock A. M. The second term begins on February 9, 1920, at 8.30 o'clock and will end with Commencement on June 16.

## EXAMINATIONS AND GRADES.

A period of two weeks is set apart for examinations and re-examinations at the end of the first term, and a period of two weeks for examinations at the end of the second term.

In reporting the standing of each student on the completion of each subject the following grades only are employed: **D** (distinguished), **G** (good), **P** (passed), **N** (not passed) student is entitled to a re-examination, **F** (failure) subject must be repeated in class, **I** (incomplete), and **O** (omitted).

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†Absences are counted from the beginning of the term.

## THESES.

The theses required of candidates for the technical degrees must be sent to the Dean on or before May 1 in each year.

## DEGREES.

The degree of *Bachelor of Science in Architecture, Bachelor of Science in Chemistry, Bachelor of Science in Chemical Engineering, Bachelor of Science in Civil Engineering, Bachelor of Science in Electrical Engineering,* or *Bachelor of Science in Mechanical Engineering* is conferred on students who complete the four-year course in one of these subjects.

The degree of *Master of Science in Architecture* (*M.S. in Arch.*) is conferred upon students who complete satisfactorily the work of the fifth, or graduate, year in the course of Architecture.

The technical degrees of *Chemical Engineer* (*Ch.E.*), *Civil Engineer* (*C.E.*), *Electrical Engineer* (*E.E.*) and *Mechanical Engineer* (*M.E.*) are conferred not less than three years after receipt of the baccalaureate degree, upon graduates of the four-year courses in these subjects who have successfully pursued their professions during such period, and who have also presented acceptable original theses.

## CERTIFICATES OF PROFICIENCY.

*Certificates of Proficiency* are awarded to students who pursue, and complete satisfactorily, the Two-Year Special Course in Architecture.

## SCHOLARSHIPS.

Scholarships open to undergraduates in the Towne Scientific School may be divided into two groups: first, those which may be held only by students from certain localities; and, second, those which are general in their allotment. All candidates for scholarships must present themselves for the usual entrance examinations, excepting those who may be admitted on satisfactory diplomas granted by public high or normal schools.

*No award of scholarships will be made until after the entrance examinations in June. Only such persons will be eligible for scholarships as have secured full admission in June preceding the opening of the year for which the scholarships are sought. Holders of scholarships who incur conditions forfeit their scholarships.*

All candidates for scholarships in the Towne Scientific School (*except those awarded by the City of Philadelphia and the Philadelphia Board of Public Education*) must transmit their applications and credentials to the *Provost on or before the 15th day of May* preceding the opening of the academic year in which they desire to enter. Scholarship application blanks may be procured from the Chairman of the Scholarship Committee (the Provost).

Special attention is called to the fact that, while possession of a scholarship entitles the holder to free tuition, such holders are bound by all University rules and regulations equally with pay students; and any infraction of these regulations will render a holder liable to the forfeiture of his privileges. A scholarship does not carry with it remission of any fee but that for tuition.

### GROUP I.

1. THE PENN SCHOLARSHIPS, two in number, founded in 1816, are filled by the Governor of the State from time to time as vacancies occur. They exist by virtue of a privilege confirmed to the heirs of Thomas Penn, one of the original Proprietaries of the Province of Pennsylvania.

2. THE PHILADELPHIA FREE SCHOLARSHIPS.—Under an agreement with the City of Philadelphia, of date 1882, fifty free scholarships exist in the University for the benefit of graduates from the public schools. Of these, THE BENJAMIN FRANKLIN SCHOLARSHIPS, three

in number, were endowed by the late Dr. William Pepper. and THE SAMUEL V. MERRICK SCHOLARSHIP by the late J. Vaughan Merrick. Candidates are examined by the Board of Public Education, and the scholarships, according to the number becoming vacant at the end of each academic year, are awarded to those who reach the highest grade in examination, provided that such grade be at least sixty-five per cent. *All inquiries concerning these Scholarships should be addressed to the Secretary of the Board of Public Education, City Hall.*

Under another agreement with the City of Philadelphia, made in 1910, seventy-five free scholarships have been established in the University for the benefit of graduates from Philadelphia schools in general. *Inquiries concerning the latter scholarships should be addressed to the Mayor of Philadelphia, City Hall.*

### GROUP 2.

1. THE BAIRD SCHOLARSHIP, founded in 1889 by Mrs. Matthew Baird, provides free tuition for one student.

2. THE MUHR SCHOLARSHIPS, founded in 1895 by the late Simon Muhr, provide free tuition for three students.

3, 4 and 5. THE JAMES LATTA (founded by William J. Latta, Esq.), ROBERT MORRIS and JOHN LOGAN SCHOLARSHIPS, established in 1900, provide free tuition for three students.

6. THE LOUISE HARRISON SCHOLARSHIP, founded in 1900 by Thomas S. Harrison, Esq., provides free tuition for one student in the Department of Chemistry.

7. THE THOMAS S. STEWART SCHOLARSHIP, founded in 1901 by Mrs. Thomas S. Stewart and the Messrs. Thomas S. and Ralph C. Stewart, provides free tuition for one student in Architecture. In the event of no suitable person presenting himself at any time in Architecture, the scholarship may be awarded in other departments.

8. THE HARTMAN KUHN SCHOLARSHIP, founded in 1901 by C. Hartman Kuhn, Esq., in memory of his grandfather, of the Class of 1800, College.

9. THE THOMAS H. POWERS SCHOLARSHIP, founded in 1901 by Mrs. Mary Powers Harris, in memory of her father.

10. The Charles Brinton Coxe Scholarship, founded in 1901 by Eckley Brinton Coxe, Jr., in memory of his father, of the Class of 1862, College.

11. The E. Otis Kendall Scholarship, founded in 1901 by the Class of 1879, College, in memory of the late Vice-Provost of the University.

12. The Thomas Cadwalader Scholarship, founded in 1901 by John Cadwalader, Esq.

13. The Stephen Greene Scholarship, founded in 1901.

14. The Class of 1878 Memorial Scholarship, founded in 1903.

15. The Architectural Alumni Scholarship, founded in 1903, provides free tuition for one student in Architecture, the nomination being vested in the Architectural Alumni Society of the University of Pennsylvania.

16. The Albert Monroe Wilson Scholarship, founded in 1904 by the Alumni of the College, in memory of the late janitor of College Hall, and as a tribute to his zealous fidelity to duty during nearly fifty years of service in the University.

17. The George Barnett Scholarship in Mechanical Engineering, founded in 1904 by his daughter, Mrs. Irene Barnett Halstead.

18. The Eckley B. Coxe Scholarship, founded in 1904 by Mrs. Eckley B. Coxe, in memory of her husband, of the Class of 1858, College.

19. Jusserand French Traveling Scholarship, founded 1912, by Joseph G. Rosengarten, Esq., awarded annually upon the recommendation of the Department of French to that student considered best prepared for study at some one of the French universities.

20. The Martha Austin McDowell Scholarship, founded in 1905 by her father, J. Austin McDowell, to be awarded without limitation as to department.

21. The Lavina Barnett Fairchild Scholarship, founded in 1906 for students in Civil Engineering.

22. The William P. Henszey Scholarship, founded in 1906 by William P. Henszey of Philadelphia, to be awarded without limitation as to department.

23. The Samuel R. Shipley Scholarship, founded in 1907.

24. The Adam Clarke Thompson Scholarship, founded in 1907, by Mrs. Robert E. Cook and Rev. William J. Thompson, in memory of their brother, of the Class of 1892, College.

25. The S. W. Roberts Scholarship, founded April, 1882.—About $50 toward the tuition of one student.

26. The John White Field Scholarship, established January, 1899.—For a student from the Central High School.

27. The Francis Peters Scholarship, established January, 1899.—For a student from the Central High School.

28. The Howard N. Potts Scholarships, established 1906.—Three free scholarships.

29. The John Clarke Sims Memorial Scholarships, founded in 1909, in memory of the late John C. Sims, a Trustee of the University, and formerly Secretary of the Pennsylvania Railroad. One of the Scholarships is open to persons nominated by the Trustees of the University, and the other is open to employes, and to sons of living or deceased employes of the Pennsylvania Railroad lines, east and west of Pittsburgh, both to be awarded under the rules governing the granting of Scholarships in the University.

30. The Coleman Sellers Scholarship, founded December 7, 1909, by Mrs. S. W. Colton, Jr., in memory of her father, provides for the tuition of a student in the Engineering Department.

31. The Drifton Scholarship.—Endowed by Mr. Eckley Brinton Coxe, Jr., May 2, 1910, to be used only for young men from the coal regions of Pennsylvania.

32. The Robert Horner Scholarship, founded in 1910 by Mr. Samuel Horner, Jr., in memory of his son, a member of the Class of 1900, College, open to any department.

33 and 34. The Charles E. Ellis Scholarships, established 1911.—The will of Charles E. Ellis provides that the beneficiaries are to be restricted to students of the public schools of Philadelphia, to be appointed by the Superintendent of the public schools through arrangement with the Commonwealth Trust Company. Two scholarships are to be available annually.

35. THE CAMDEN (N. J.) MANUAL TRAINING HIGH SCHOOL SCHOLARSHIP, established in January, 1910, by the Associate Alumni of that school, is awarded annually to a graduate of the same, subject to all the rules and regulations of the University.

36, 37 and 38. WALTER E. HERING SCHOLARSHIPS.—Three scholarships, established 1910, open for five years in any department of the University.

39. THE GEORGE W. FETTER SCHOLARSHIP, established in May, 1910, by Mrs. George W. Fetter, in memory of her husband, subject to all the rules of the University.

40. CLASS OF EIGHTY-SIX COLLEGE MEMORIAL SCHOLARSHIP FUND.—Founded 1912 by the Class of 1886, College, for the tuition of one student.

41. HENRY WILSON SPANGLER MEMORIAL SCHOLARSHIP IN ENGINEERING, founded February, 1914, by the graduates of the Towne Scientific School, provides for the tuition of one student, preference to be given to needy students in the following order: Mechanical, Electrical, Chemical and Civil Engineering; in any allied branch of Engineering, or in Architecture.

## PRIZES FOR 1919-20.*

### FRESHMAN ENTRANCE PRIZE.

THE EUGENE DELANO PRIZE of fifty dollars for the best special examination in the French and German required for entrance.

### I. PRIZES FOUNDED BY ORGANIZATIONS.

1. THE HENRY REED PRIZE, founded by the SOCIETY OF THE ALUMNI (College), for the best English Essay by a member of the Senior Class, College, Wharton or Towne Scientific Schools, entitles the successful competitor to one year's interest on six hundred dollars. Essays in competition for this prize are handed to the Dean of the College for transmission to a committee of the Board of

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*All essays in competition for prizes must be handed to the appropriate Dean on or before May 1 in each year, must be signed with a fictitious name, and be accompanied by a sealed envelope, on which is written the fictitious name, and in which are enclosed the writer's real name and address. No prize will be awarded unless the work done for it reaches a high standard of excellence. Unless otherwise stated, the prizes are open to regular students only.

Trustees, by whom the prize is awarded. A definite subject is announced for each year's competition.

2. A prize founded by the PHI KAPPA SIGMA FRATERNITY in honor of their founder, Samuel Brown Wylie Mitchell, M.D., of the Class of 1852, for the most meritorious work done in the course in English Composition of the second year. It entitles the successful competitor to one year's interest on four hundred dollars.

3. THE ASSAYERS AND MINERS GANGUE offers a prize of the value of twenty-five dollars in books or apparatus to Seniors in Chemistry; the prize to be awarded by the Gangue with the advice of the professor in charge.

4. THE PRIESTLEY CLUB, composed of Alumni of the Chemical Department, offers a prize of twenty dollars each year to that member of the Graduating Class of that Department, whose work for that year is most satisfactory. The award of the prize is to be determined by the Director of the John Harrison Laboratory of Chemistry, based upon the student's application, the grade obtained by examination, and the presentation of a satisfactory thesis.

5. THE DANTE SOCIETY offers annually a prize of one hundred dollars for the best essay on a subject drawn from the life and works of Dante. Competition is open to all students, and graduates of not more than three years' standing, of any college or university in the United States. The judges of the essays submitted are a committee of the Society. For further information address the Secretary of the Society, Professor F. N. Robinson, Longfellow Park, Cambridge, Mass.

6. THE PHILADELPHIA GROUP OF THE ALLIANCE FRANCAISE, established in 1904, awards annually a medal to the student of either the Junior or Senior classes who has done the most meritorious work in French over and above the required courses.

7. THE FELLOWSHIP IN ARCHITECTURE of the American Academy in Rome, open for competition among qualified undergraduates and graduates of certain American architectural schools, including that of the University of Pennsylvania. This fellowship grants three years of residence and travel abroad for the study of Classic and Renaissance architecture.

8. FACULTY MEDAL IN ARCHITECTURE.—The staff of instruction in Architecture will provide and award a medal to that student, can-

didate this year for the degree in architecture, who shall have attained the highest standing throughout his Senior year.

9. THE AMERICAN INSTITUTE OF ARCHITECTS will award a medal to that student receiving the degree of Bachelor of Science in Architecture, who shall have had the highest record in his class throughout his course. This medal is likewise offered in each of the Schools of the Association of Collegiate Schools of Architecture.

10. "THE SOCIÉTÉ DES ARCHITECTES DIPLÔMÉS" of France assigns to the Architectural Department for award, to encourage the higher study of architecture, two medals, one in silver-gilt and the other in silver. These medals will be awarded among those students completing in 1919 the program of graduate design in Architecture, the first for distinguished excellence and the second for superior excellence. The Faculty reserves the right to withhold the award if in either case no record of such merit is achieved.

11. ORATORY PRIZE FUND, founded 1874 by the Society of the Alumni. A prize for the best and a prize for the second best original declamation by a member of the Junior Class; the first prize of $25, and the second prize of $15.

12. THE PARIS PRIZE OF THE SOCIETY OF BEAUX ARTS ARCHITECTS, granting to the winner two and a half years of residence in Paris as students in the Ecole des Beaux Arts. This prize is supplied by the Paris Prize Committee, incorporated, from funds donated by friends and members of the Society.

## II. PRIZES FOUNDED BY INDIVIDUALS.

1. A prize founded by HENRY LABARRE JAYNE, of the Class of 1879, for the best English Composition by a member of the Freshman Class. It entitles the successful competitor to one year's interest on two hundred dollars. A definite subject is announced for each year's competition.

2. A prize, originally founded by the late D. VAN NOSTRAND and generously continued by his business successors, for the member of the Junior Class in Civil Engineering who attains the highest general average of scholarship during the Junior year. The prize consists of twenty-five dollars.

3. THE FRAZIER PRIZE.—GEORGE H. FRAZIER, of the Class of 1887, offers annually a prize (founded 1897) of a standard work in literature, to be chosen by him, and of a value of one hundred

dollars, to the student in the College, Towne Scientific or Wharton Schools of the University of Pennsylvania, who, being a member of the Football team, Baseball team, Track team, or of the Crew, shall attain the highest standing in scholarship.

4. The Arthur Spayd Brooke Memorial Prize in the School of Architecture, of a cash value of fifty dollars, is awarded annually, in the form of medals, for meritorious work in design, as follows: for the best record of distinguished rank, a Gold Medal of about forty dollars in value; for records of second and third place and of superior excellence, a Silver and a Bronze Medal, respectively. This prize was established in 1901 by Maria Wharton Brooke, as a memorial to her son, Arthur Spayd Brooke, a graduate in Architecture of the Class of 1897.

5. The John Stewardson Memorial Scholarship in Architecture.—The value of this scholarship (established in 1897) is one thousand dollars, and the holder is required to spend one year in travel and in the study of Architecture under the direction of the Managing Committee. Candidates must be architectural students or practitioners under thirty years of age, resident in the State of Pennsylvania for at least one year immediately preceding the date of preliminary examinations, which must be passed unless acceptable certificates therefor are presented. The Managing Committee reserves the right to postpone the competition in any calendar year.

6. The Philo S. Bennett Prize, given through the generosity of the Honorable William J. Bryan. The interest on four hundred dollars is to be awarded annually for the best essay on *The Principles of Free Government.*

7. Hugo Otto Wolf Memorial Prize.—Founded 1912 by the gift of Otto C. Wolf, in memory of his son. To be awarded to any member of the Senior Class in each of the Engineering Courses—Mechanical, Electrical, Civil and Chemical Engineering—who, during the Senior year, by the thoroughness and originality of his work, meets with the greatest approval of the professors in charge.

8. Historic Ornament Prizes.—Two medals, a first and second, offered by John Frederick Harbeson, M.S. in Arch., 1911, for the year's record of excellence of first and second grades in Historic Ornament.

## COURSES IN THE TOWNE SCIENTIFIC SCHOOL.

The Faculty of the Towne Scientific School conducts the following courses:

1. *The Courses in Architecture.*
2. *The Course in Chemical Engineering.*
3. *The Course in Chemistry.*
4. *The Course in Civil Engineering.*
5. *The Course in Electrical Engineering.*
6. *The Course in Mechanical Engineering.*

1. (a) *The Full Course in Architecture* leads to the degree of *Bachelor of Science in Architecture* and requires normally four years for completion.

(b) *The Graduate Course in Architecture* leads to the degree of *Master of Science in Architecture* and requires normally one additional year for completion.

(c) *The Two-year Special Course in Architecture* leads, on completion, to a certificate of proficiency in Architecture.

(d) *The Course in Architectural Engineering* leads to the degree of *Bachelor of Science in Architecture* and requires normally four years for completion.

2. *The Course in Chemical Engineering* leads to the degree of *Bachelor of Science in Chemical Engineering* and requires four years for completion.

3. *The Course in Chemistry* leads to the degree of *Bachelor of Science in Chemistry* and requires four years for completion.

4. *The Course in Civil Engineering* leads to the degree of *Bachelor of Science in Civil Engineering* and requires four years for completion.

5. *The Course in Electrical Engineering* leads to the degree of *Bachelor of Science in Electrical Engineering* and requires four years for completion.

6. *The Course in Mechanical Engineering* leads to the degree of *Bachelor of Science in Mechanical Engineering* and requires four years for completion.

## THE COMBINED COURSES IN THE COLLEGE AND THE TOWNE SCIENTIFIC SCHOOL.

These Combined Courses are designed to meet the needs of such students as may desire to acquire a broad and general foundation prior to taking up work leading to the degree in the particular course they have selected in the Towne Scientific School. The Combined Courses normally extend throughout a period of six years.

The work in the College is designed to give the student greater maturity of thought and breadth of view, thus better fitting him in every way for the more specialized work to follow.

A student with the required preparation may in four years complete all of the requirements for the Bachelor's degree in the College and at the same time all of the required work of the first two years in any of the regular courses in the Towne Scientific School.

Such a student is then admitted to the Junior Class in the Towne Scientific School, thereby enabling him to complete his course in the latter in two additional years.

Exceptional students entering the College with advanced credit may possibly be able to complete Combined Courses in less than six years.

A student entering with the intention of taking one of these Combined Courses must so specify to the Dean of the College in order that he may be assigned to a special adviser.

Such a student shall normally register for the first four years in the College.

For further information consult the Dean of the Towne Scientific School.

## THE TOWNE SCIENTIFIC SCHOOL.

A regular scientific course leading to a degree has existed in the College since the year 1852. In 1872 this course was enlarged and organized as a Department of Science, which, in 1875, was in large part endowed under the provisions of the will of the late JOHN HENRY TOWNE, a trustee of the University. In honor of his memory the Department of Science was named *The Towne Scientific School*, which now comprehends the courses in Architecture, in Chemistry, in Chemical Engineering, in Civil Engineering, in Electrical Engineering, and in Mechanical Engineering.

## ENGINEERING BUILDING.

The departments of Civil, Electrical, Mechanical and Chemical Engineering of the Towne Scientific School occupy a separate building. It is 300 feet long and 160 feet deep, with a wing 50 feet wide and 40 feet deep at one end, the total working floor space being approximately 128,000 square feet. The construction is fire proof throughout.

The building contains the necessary accommodations for serving as headquarters for all the students in engineering, and a sufficient number of class rooms and drawing rooms for handling all the technical subjects of the departments. In addition it contains extensive laboratories fully equipped with the best modern apparatus for experimental work, pertaining to Civil, Electrical and Mechanical Engineering, including the testing of steam and gas engines, boilers, electric and hydraulic motors, dynamos, transformers and electrical apparatus, pumps and fans, refrigerating machinery, the investigation of the physical properties of the materials of engineering, the study of the laws governing the flow and discharge of water through orifices, weirs and pipes, and facilities for calorimetric and geodetic work. The shops are fully equipped for practical instruction in wood and iron working, forge and foundry work.

## THE ARCHITECTURAL BUILDINGS.

The Department of Architecture occupies two structures, "The Architectural Building" and "The Studio." The former is a large building containing twenty-two rooms including drafting rooms (the larger of which has a floor area of eight thousand square feet); a large library; lecture and exhibition rooms; administration, seminar and drawing rooms; professors' studies and a room for the Architectural Society. The Studio, with good north light, offers facilities for instruction in Freehand and Water Color Drawing of various grades.

## THE COURSES IN ARCHITECTURE.

### OFFICERS.

EDGAR F. SMITH, PROVOST.

JOSIAH H. PENNIMAN, PH.D., LL.D., VICE-PROVOST.

HENRY B. EVANS, M.E., PH.D., DEAN OF THE TOWNE SCIENTIFIC SCHOOL.

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WARREN POWERS LAIRD, SC.D., *Architecture: Professor in Charge.*

PAUL PHILIPPE CRET, A.D.G.F. (*Atelier Pascal*), O.L.A., SC.D., *Professor of Design.*

HERBERT EDWARD EVERETT, *Professor of the History of Art.*

GEORGE WALTER DAWSON, *Professor of Drawing.*

THOMAS NOLAN, PH.B., M.S., A.M., *Professor of Architectural Construction.*

PAUL A. DAVIS, 3D, B.S., A.D.G.F. (*Atelier Pascal*), *Acting Professor of Design.*

JOHN WYNKOOP, B.S. in Arch. (*Paris Prize, Atelier Bernier*), *Acting Professor of Design.*

ALFRED H. GUMAER, B.S. in Arch., *Assistant Professor of Architectural History.*

PHILIP RICHARDSON WHITNEY, B.S. in Arch., *Assistant Professor of Graphics.*

*LEON ARNAL, A.D.G.F., *Assistant Professor of Design.*

GEORGE HOWARD BICKLEY, B.S. in Arch., A.D.G.F. (*Atelier Redon*), *Assistant Professor of Design.*

ROBERT RODES MCGOODWIN, B.S. and M.S. in Arch., *Instructor in Design.*

——— ——— ———, *Instructor in Architectural Construction.*

——— ——— ———, *Instructor in Design.*

*JOHN F. HARBESON, B.S. and M.S. in Arch., *Assistant in Design.*

FRANCIS ROGERS BACON, B.S. in Arch., A. M., *Instructor in Architecture and Architectural Construction.*

GERALD A. ANDERSON, *Assistant in Architecture.*

——— ——— ———, *Instructor in Life Drawing.*

J. HORACE FRANK, B.S. in Arch., *Evening Instructor.*

J. CRAIG JANNEY, *Assistant in Architecture.*

PAUL FORRESTER TAYLOR, *Assistant in Drawing.*

ALVIN C. BIEBER, *Reader in Architecture.*

JOHN PLATT ROBERTS, *Reader in Architectural Construction.*

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* Absent on leave.

## OTHER OFFICERS OF INSTRUCTION.

Give courses as follows: English, Modern Languages, Mathematics and History in the College; Hygiene, in the Department of Hygiene; Testing of Materials in the Department of Civil Engineering.

### SPEAKERS IN THE SPECIAL LECTURE COURSE FOR 1918-19.

(See page 100.)

### SPEAKERS ON PROFESSIONAL PRACTICE, 1917-1918.

(One hour each.)

MILTON B. MEDARY, JR., F.A.I.A. HORACE WELLS SELLERS, F.A.I.A.

(Two hours.)

FRANK MILES DAY, F.A.I.A.

### THE FULL COURSE IN ARCHITECTURE.

The University offers a full professional course of instruction, leading to the degree of Bachelor of Science in Architecture. While no period is fixed for the completion of its work, the average student can, with diligence, accomplish this in four years.

### GRADUATE COURSE.

A Graduate year of instruction is offered, with wide range of selection among subjects for specialization, the degree of Master of Science in Architecture being granted upon its completion. This course is described on pages 69-70.

### SPECIAL COURSE.

There is offered also a special course of study, open to qualified architectural draughtsmen and comprising the technical subjects most needed by them. This may be completed in two years and leads to a professional certificate in architecture.

### COMBINED COURSE IN ARTS AND SCIENCE AND IN ARCHITECTURE.

A candidate for the A.B. degree in the College may secure also the Bachelor's Degree in Architecture in a total of six years of work. For the details of this arrangement, address or consult Professor Laird.

### Summer School Instruction.

(See page 94.)

### Entrance Requirements.

Requirements for admission to all courses in architecture are given under "Admission," pages 23-38.

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## OUTLINE OF INSTRUCTION.

### The Full Course.

The University aims to secure to its graduates in Architecture the general training prerequisite to the demands of the best professional practice. To that end the scheme of study combines complete technical instruction with the essentials of a liberal education. The purely professional work is so arranged as to lay a broad and solid foundation for the future needs of the practicing architect, while incidentally preparing the student to become, upon graduation, of immediate usefulness as an architect's assistant. The liberal elements of the course include both those studies essential to a general college education, and those forming that part of the professional curriculum in which special stress is laid on the esthetic side of architecture.

The course of study is organized upon the principle that architecture is primarily a fine art. The study of design is therefore emphasized, the student being required to give to it and to its preparatory and accessory subjects an important portion of his time throughout the course. Supporting this line of study and broadening the general view of the student are the history courses, covering exhaustively the field of architecture and giving general treatment to that of painting and sculpture. Thorough courses are given in the theory and practice of building construction, of building sanitation and on the nature and use of building materials. Draughtsmanship receives constant attention throughout the course, not only in the courses in design and graphics, but also in various lines of instruction in pure drawing.

The professional work thus outlined covers some three-fourths of the student's time. The remainder is devoted to general studies, which are pursued during the first two years of the course, and which include two years each of English (composition, rhetoric and literature); of Modern Foreign Language. and of Mathematics (Trigonometry, Analytic Geometry and Calculus); and on year of Medieval History. The instruction in these subjects is that given also in the course in Arts and Science.

The Department of Architecture has a large equipment, comprising a working library of over one thousand volumes; a file of leading American and foreign periodicals; over twenty thousand mounted photographs, plates, illustrations, and lantern slides, classified for ready reference; numerous autograph drawings and models; and a collection of casts from the antique, architectural ornament, etc. The school occupies two structures, "The Architectural Building" and "The Studio." The former is a large building containing twenty-two rooms including drafting rooms (the larger of which has a floor area of eight thousand square feet); a large library; lecture and exhibition rooms; administration, seminar and drawing rooms; professors' studies and a room for the Architectural Society. The Studio, with good north light, offers facilities for instruction in Freehand and Water Color Drawing of various grades.

## The Course in Architectural Engineering.

The subject of advanced architectural construction is so presented in the School of Architecture that it constitutes a complete course of study leading as distinctly toward special preparation in this field as does the general course toward that in general architectural practice. The fundamental work in each course is the same and specialization takes place in advanced subjects. To this end, the course is so organized that it assures the student both phases of those subjects essential in architectural engineering, namely, a special knowledge of its principles and their application combined with the general grounding in architecture demanded in the equipment of every practitioner, whatever his special line of activity.

The course, briefly outlined, comprises the following essentials: (1) The fundamentals of a general education; (2) Acquaintance with the underlying theory and the history of architecture; (3) Technical training in drawing and design; (4) Knowledge of the theory and practice of building construction, and, finally and chiefly, (5) Such advanced work in the latter as will prepare the student for work in the special field of architectural engineering.

The completion of this course is rewarded by the degree granted in the general course, that of Bachelor of Science in Architecture.

## THE TWO-YEAR SPECIAL COURSE.

Architectural draughtsmen of experience, desiring to supply deficiencies in technical training and unable to give the time necessary to the completion of the full or regular course, are admitted as special students, if eligible under certain requirements indicated on page 28. Such students pursue a definite course of study, arranged to permit the completion, in two years, of much of the advanced technical work of the four-year course; and they may, when prepared, specialize in the subjects peculiar to the course in Architectural Engineering. Also, when prepared at entrance with any of the subjects of the course, they may at once take advanced work in such subjects, thus comprising within the time limit of their course subjects otherwise lying beyond it. A satisfactory completion of this course is recognized by the award of a professional certificate.

## ADVANCED STANDING.

Credit is given in any subject of study for fully equivalent work done elsewhere. This permits advanced standing, in the full course, for both "academic" and "technical" subjects, and, in the Special Course, for the latter.

The work of the course in design and in drawing is so arranged that each student, upon admission, is placed in the grade for which he is fitted and may then progress as rapidly as his ability will warrant. To secure standing in any grade beyond the first, the student must present satisfactory evidence of his previous work or undergo a test, or both, as the instructor may require.

## TUITION.

Tuition fees for the courses in Architecture are two hundred dollars ($200.00) per annum.

## FELLOWSHIPS, SCHOLARSHIPS AND PRIZES.

The following rewards are open to students in the School of Architecture or to its graduates:

Open to general competition in the United States:

THE PRIZE OF THE AMERICAN ACADEMY IN ROME (page 49). (Awarded to University of Pennsylvania graduates 1911 and 1914.)

THE PARIS PRIZE OF THE SOCIETY OF BEAUX ARTS ARCHITECTS (page 50). (Awarded to University of Pennsylvania graduates 1911-12-13-14.)

Medals assigned to the University of Pennsylvania:

THE MEDAL OF THE AMERICAN INSTITUTE OF ARCHITECTS (page 50).

THE MEDALS OF THE SOCIÉTÉ DES ARCHITECTES DIPLÔMÉS (page 50).

Open throughout the State of Pennsylvania:

THE JOHN STEWARDSON MEMORIAL SCHOLARSHIP (page 51). (Awarded to University of Pennsylvania students or graduates fifteen times in eighteen awards since foundation.)

Open only to University of Pennsylvania students:

THE ARTHUR SPAYD BROOKE MEMORIAL PRIZE (page 51).
THE THOMAS S. STEWART SCHOLARSHIP (page 45).
THE ARCHITECTURAL ALUMNI SOCIETY SCHOLARSHIP (page 46).
THE FACULTY PRIZE MEDAL (page 49).
THE HARBESON MEDALS (page 51).

# OUTLINE OF THE FULL COURSE.

For the Normal Schedule of this course see page 66.

## I. ARCHITECTURAL SUBJECTS.

### PRACTICE, ETHICS AND THEORY OF DESIGN.

| Title of Subject | Hours per week | Unit Value of Subject* | Subject Number | For description see page |
|---|---|---|---|---|
| Professional Practice | 1 | 1 | 47 | 99 |
| Special Lectures | 1 | 1 | 48 | 100 |
| Composition and Theory of Design. | 1 | 1 | 49 | 100 |

### DESIGN.

| | | | | |
|---|---|---|---|---|
| Design, Grade I‡ | 8 | 1 | 1 | 95 |
| " " II‡ | 18 | 4† | 2 | 95 |
| " " III‡ | 18 | 4† | 3 | 95 |
| " " IV‡ | 24 | 5 | 4 | 95 |
| " " V‡ | 24 | 5 | 5 | 95 |
| " " VI | 32 | 14 | 6 | 95 |
| Elements of Architecture | 8 | 1½ | 9 | 96 |
| | | ½ | 10 | 96 |

*A unit of work consists of one lecture or recitation with preparation, each week for one year, or its equivalent in actual time in drafting room, studio or laboratory, about 2¼ hours.

†Four units for Regulars; five units for Specials.

‡ Part of year.

**Note.**—Any student who completes Grade II of design before his class finishes 28 may enter Grade III, if in Grade II he has shown a satisfactory working knowledge of 28. This applies also to the entering of Grade IV with respect to 29.

## HISTORY.

| Title of Subject | Hours per week | Unit Value of Subject | Subject Number | For description see page |
|---|---|---|---|---|
| Ancient Architectural History, First Term | 3 | 1½ | 42 | 99 |
| Medieval Architectural History, Second Term | 3 | 1½ | 43 | 99 |
| Renaissance and Modern Arch'al Hist. | 3‡ | 2 | 44 | 99 |
| History of Painting | 1 | 1 | 45 | 99 |
| " " Sculpture | 1 | 1 | 46 | 99 |

## DRAWING.

| | | | | |
|---|---|---|---|---|
| *Architectural Drawing* | 12 | 1 | 26 | 97 |
| *(a)* Instrumental | | | | |
| *(b)* Pencil | | | | |
| *(c)* Brush | | | | |
| *(d)* Lettering | | | | |
| *Graphics*— | | | | |
| Descriptive Geometry* | 6 | 2 | 27 | 97 |
| Shades and Shadows* | 3 | 1 | 28 | 97 |
| Perspective | 6 | 1 | 29 | 97 |
| *Freehand Drawing*†— | | | | |
| Pure Freehand; six grades, viz.: | | | | |
| I. Form and Proportion | 4 | 1 | 11 | 96 |
| II. Light and Shade (charcoal) | 4 | 1 | 12 | 96 |
| III. Cast; Arch't'l Ornament | 4 | 1 | 13 | 96 |
| IV. Cast; Figure Details | 4 | 1 | 14 | 96 |
| V. Antique | 4 | 1 | 15 | 96 |
| VI. Life† | 4 | 2 | 16 | 96 |
| Drawing and Design: | | | | |
| I. Historic Ornament | 4 | 1 | 20 | 96 |
| Water Color; four grades, viz.: | | | | |
| I. Still Life, Monochrome | 3 | 1 | 21 | 96 |
| II. Still Life, Color | 3 | 1 | 22 | 96 |
| III. Rendering of Arch't'l object. | 3 | 1 | 23 | 96 |
| IV. Rendering of Photo. subject. | 3 | 1 | 24 | 96 |

**Note.—The student must continue pure freehand drawing until his completion of design. If Grade VI of the former is finished before the latter, drawing from the life will thereupon become an essential part of the work in design.**

*Part of each term.

†Grade VI (Life) occupies a full year, the remaining subjects, normally, one-half year each.

‡Second term, 2 hours.

## ARCHITECTURAL CONSTRUCTION.

| Title of Subject | | Hours per week | Unit Value of Subject | Subject Number | For description see page |
|---|---|---|---|---|---|
| Arch. Const'n | Mechanics of Architecture.. | 5† | 2 | 30 | 97 |
| | Carpentry*................ | 3 | 2 | 32 | 97 |
| | Masonry and Ironwork* .. | 3 | 2 | 33 | 98 |
| Graphic Statics in Architecture ..... | | 7‡ | 2 | 31 | 97 |
| Sanitation of Buildings | Hygiene ............... | 1§ | 1 | 1 | 119 |
| | Heat. and Vent. ....... | 1§ | | 34 | 98 |
| | Plumb. and Drain....... | 1§ | | 35 | 98 |

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* Given in alternate years; 1 hour lectures and quizzes, 2 hours research and drawing; 33 in 1918-19; 32 in 1919-20.

† First term; 3 hours lecture, 2 hours research.

‡ First term for second-year special students and second term for juniors; 3 hours lecture, 4 hours research and drawing.

§ Ten lectures each.

## ARCHITECTURAL ENGINEERING.

This constitutes an option in the fourth year in which the following work in advanced architectural construction may be substituted for all the subjects of the regular course, except courses 47, 48 and Phys. Ed. 4.

| Title of Subject | Hours per week | Unit Value of Subject | Subject Number | For description see page |
|---|---|---|---|---|
| Architectural Construction: Design; Grade B (see note)...... | 26 | 6 | 37 | 98 |
| Architectural Construction: Design; Grade A ................ | 26 | 6 | 38 | 98 |
| Architectural Construction: Theory ...................... | 6* | 4 | 39 | 98 |
| Foundations of Buildings ....... | 3† | 1 | 40 | 99 |
| Specifications, Estimates and Contracts ......................... | 3‡ | 1 | 41 | 99 |
| Reinforced Concrete ........... | 3§ | 1 | C.E. 48 | 108 |
| Testing Laboratory (Cement) ... | 2§ | 1 | C.E. 37 | 107 |
| Testing Laboratory (Iron, Steel, etc.) ......................... | 2‖ | 1 | C.E. 65 | 109 |

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* 1 hour lecture, 5 hours drawing.

† 1 hour lecture, 2 hours drawing, first term.

‡ 1 hour lecture, 2 hours research and writing, part of second term.

§ First term.

‖ Second term.

Note.—Completion of Design Grade IV must precede Grade B Construction Design.

## II. NON-ARCHITECTURAL SUBJECTS.

### FIRST YEAR.

| Title of Subject | Lect. or Rec. per week | | Unit Value of Subject | Subject Number | For description see page |
|---|---|---|---|---|---|
| | 1st Term | 2d Term | | | |
| *English—* | | | | | |
| Composition | 2 | 2 | 2 | 1 | 113 |
| Language | — | 2 | 1 | 30 | 114 |
| Literature | 2 | — | 1 | 40 | 114 |
| **French—* | | | | | |
| Elementary (elective) | 4 | 4 | 4 | 1 | 116 |
| Reading | 2 | 2 | 2 | 2 | 116 |
| Composition | 1 | 1 | 1 | 3 | 116 |
| *Mathematics—* | | | | | |
| Trigonometry | 4 | — | 2 | 33 | 120 |
| Analytical Geometry | — | 4 | 2 | 34 | 120 |
| *History—* | | | | | |
| Medieval | 3 | 3 | 3 | 3 | 119 |
| †*Physical Education* | 2 | 2 | 1 | 1 | 127 |

### SECOND YEAR.

| | | | | | |
|---|---|---|---|---|---|
| *English—* | | | | | |
| Composition | 1 | 1 | 1 | 3 | 114 |
| Literature | 2 | — | 1 | 42 | 115 |
| **French—* | | | | | |
| Reading | 2 | 2 | 2 | 4 | 116 |
| Composition | 1 | 1 | 1 | 5 | 116 |
| *Mathematics—* | | | | | |
| Calculus Differential | 3** | — | 1 | 37 | 120 |
| " Integral | — | 3** | 1 | 38 | 120 |
| †*Physical Education* | 2 | 2 | 1 | 2 | 127 |

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*German, Italian or Spanish may be taken in lieu of French, but it is strongly recommended that the French be elected because of its relatively much greater usefulness to architects. The volume of work required in other languages is similar to that of French. When German, Italian or Spanish is presented for admission, Elementary French may be taken in the first year of the course, followed by French 2 and 3, and French 4 and 5, in the second and third years respectively.

†Physical education is a required course and must be taken during 2 hours each week for the four years spent in the course. This allows 1 unit credit for each year in this subject.

**2 hours recitation, 1 hour practice.

## OUTLINE OF THE SPECIAL COURSE.*

Leading to the Certificate of Proficiency in Architecture.

This course comprises technical subjects of full course as follows:
Drawing—28, 29, 13, 14, 15, 20, 21, 22 and 23.
History and Practice—42, 43, 44, 46, 47 and 48.
Architectural Construction—31, 34, 35, 36, and Hygiene 1.
Design—2, 3, 4, 5, 9, 10 and 49.
Physical Education—1 and 2.

For description of these subjects and their unit values see pages 95 to 100 inclusive, and for the normal schedule of the course see page 68.

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*Special students who have presented entrance Mathematics (A, C, D and F) may attend classes in Mechanics of Architectural Construction (30) as auditors, while those who have had the mathematics of the full course may elect and receive credit for this subject. Physical Education is a required course and must be taken for 2 hours each week for the two years spent in the course. This allows one unit credit for each year in this subject. Special students who at entrance are deficient in elementary freehand or in instrumental drawing will take these subjects in course.

## NORMAL SCHEDULES.

The studies enumerated below constitute the full course. They are presented in such sequence that the average student can complete them in four years by taking in each academic session 24 units of work. The following schedule indicates the student's normal progress, but the subjects are so presented as to allow for advanced standing and for a progress in design and drawing according to individual ability.

### SCHEDULE OF THE REGULAR FOUR-YEAR COURSE.

### Leading to the Degree of B.S. in Architecture.

**FIRST YEAR.**

| Subject No. | Units | |
|---|---|---|
| | 1st Term | 2d Term |
| Arch. 26; Arch. Drawing | 1 | — |
| " 11; Freeh'd " | 1 | — |
| " 12; " " | — | 1 |
| " 9; El. of Arch.... | 1½§ | — |
| " 10; " " ... | — | ½ |
| " 1; Elem. Design. | — | 1 |
| " 27; Desc. Geom.... | 1 | 1 |
| " 28; Shades and Shadows. | 0.5 | 0.5 |
| Architectural Units.. | 9 | |
| Eng. 1; Composition .. | 1 | 1 |
| " 40; Language ..... | 1 | — |
| " 30; Literature .... | — | 1 |
| Fr. 2†; Reading....... | 1 | 1 |
| " 3†; Composition... | 0.5 | 0.5 |
| Math. 33; Trigonometry | 2 | — |
| " 34; Anal. Geom.. | — | 2 |
| Hist. 3; Medieval...... | 1.5 | 1.5 |
| Physical Education 1 | 0.5 | 0.5 |
| Non-Architectural Units ............... | 15 | |
| First Year Units ...... | 24 | |

**SECOND YEAR.**

| Subject No. | Units | |
|---|---|---|
| | 1st Term | 2d Term |
| Arch. 2; Design Gr. II | 2 | 2 |
| " 3; " " III | — | 4 |
| " 13; Freeh'd Draw. | 1 | — |
| " 14; Freeh'd Draw. | — | 1 |
| " 42; Arch. History | 1.5 | |
| " 43; Arch. History | | 1.5 |
| " 29; Perspective... | 1 | — |
| " 32; Carp. Const'n | 1 | 1 |
| Architectural Units.. | 16 | |
| Eng. 3; Composition .. | 0.5 | 0.5 |
| " 42; Literature .... | 1 | — |
| Fr. 4†; Reading....... | 1 | 1 |
| " 5†; Composition... | 0.5 | 0.5 |
| Math. 37; Calculus...... | 1 | — |
| " 38; " ...... | — | 1 |
| Physical Education 2 | 0.5 | 0.5 |
| Non-Architectural Units ............. | 8 | |
| Second Year Units ... | 24 | |

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† Or one other language as noted on page 64.
§ Part of each term.

**THIRD YEAR.**

| Subject No. | Units<br>1st Term | Units<br>2d Term |
|---|---|---|
| Arch. 21; Wat. Col. Dr... | 1 | — |
| " 44*; Arch. History. | 1 | 1 |
| " 4; Design Gr. IV | 4 | 1 |
| " 5†; " " V | — | 5 |
| " 20; Hist. Ornam't | — | 1 |
| " 15; Freeh'd Draw. | 1 | — |
| " 22; Wat. Col. Dr. | — | 1 |
| " 30; Mech. of Arch. | 2 | — |
| " 31; Graphic Statics | — | 2 |
| " 33; M. & I. Const. | 1 | 1 |
| Hyg. 1; Hygiene<br>Arch. 34; Heat.&Vent.<br>" 35; Pl. & Drain. | 0.5 | 0.5 |
| Physical Education 3.... | 0.5 | 0.5 |
| Total ................ | 24 | |

**FOURTH YEAR.**

| Subject No. | Units<br>1st Term | Units<br>2d Term |
|---|---|---|
| Arch. 6; Design Gr. VI | 7 | 7 |
| " 16; F. H. Life ... | 1 | 1 |
| " 23; Water Color Rend. ........ | 1 | — |
| " 24; Water Color Rend. ........ | — | 1 |
| " 45; Hist. of Paint. | 0.5 | 0.5 |
| " 46; Hist. of Sc'lpt. | 0.5 | 0.5 |
| " 47; Prof. Practice. | 0.5 | 0.5 |
| " 48; Special Lect... | 0.5 | 0.5 |
| " 49; Theory of Des. | 0.5 | 0.5 |
| Physical Education 4... | 0.5 | 0.5 |
| Total ................. | 24 | |

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* May extend over one term.

† In the case of Arch Eng. Students whose records warrant Arch. 5 may be incorporated with Arch. 37 and 38.

## SCHEDULE OF THE FOUR-YEAR COURSE IN ARCHITECTURAL ENGINEERING.

Leading, as in the regular course, to the degree of B.S. in Arch.

The work of the first three years is identical with that of the regular course, and the student is thus not obliged to choose his specialization until the end of his third year. The fourth year is composed of work in advanced architectural construction and of three subjects common to both courses (47, 48 and Phys. Ed. 4), as follows:

**FOURTH YEAR.**

| Subject and Number of Course | Unit Values<br>1st Term | Unit Values<br>2d Term |
|---|---|---|
| Arch. 37*; Architectural Construction: Design—Grade B ...... | 6 | — |
| " 38; " " Design—Grade A ...... | — | 6 |
| " 39; " " Theory ................ | 2 | 2 |
| " 40*; Foundations of Buildings ........................ | 1 | — |
| " 41†; Specifications, Estimates and Contracts .......... | — | 1 |
| " 47; Professional Practice ............................ | 0.5 | 0.5 |
| " 48; Special Lectures ................................. | 0.5 | 0.5 |
| C. E. 48; Reinforced Concrete ............................ | 1 | — |
| " 37; Testing Laboratory (Cement) ...................... | 1 | — |
| " 65†; " " (Iron, Steel, etc.) ............ | — | 1 |
| Phys. Ed. 4. Gymnasium ........................................ | 0.5 | 0.5 |
| Total ................................................. | 24 | |

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*May extend over more than one term.

†Part of second term.

## SCHEDULE OF THE TWO-YEAR SPECIAL COURSE.

### Leading to the Certificate of Proficiency in Architecture.

| FIRST YEAR. | | SECOND YEAR. | |
|---|---|---|---|
| Subject No. | Units | Subject No. | Units |
| Arch. 9; El. of Arch. ......... | 1½ | Arch. 4; Design, Gr. IV ...... | 5 |
| " 10; " " ......... | ½ | " 5; " " V ...... | 5 |
| " 28; Shades and Shadows*.. | 1 | " 14; Freehand Drawing .... | 1 |
| " 29; Perspective*.......... | 1 | " 15; F. H. Draw., Antique | 1 |
| " 2; Design Gr. II ....... | 4 | " 20; Hist. Ornament ..... | 1 |
| " 3; " " III ....... | 5 | " 22; Water Color Drawing . | 1 |
| " 11; Freehand Drawing .... | 1 | " 23; Wat. Col. Rend. ..... | 1 |
| " 12; " " .... | 1 | " 31; Graphic Statics ...... | 2 |
| " 13; " " .... | 1 | Hyg. 1; Hygiene<br>Arch. 34; Heat and Vent.<br>" 35; Pl. and Drain. .... | 1 |
| " 21; Wat. Col. Drawing... | 1 | " 44; Arch. Hist. (Ren. & Mod.) ............... | 2 |
| " 42; Anc. Arch. Hist....... | 1½ | " 46; Hist. of Sculpt. ..... | 1 |
| " 43; Med. Arch. Hist...... | 1½ | " 47; Professional Practice | 1 |
| " 36; Strength of Materials. | 2 | " 48; Special Lectures .... | 1 |
| " 49; Theory of Design..... | 1 | Phys. Ed. 2 Gymnasium ..... | 1 |
| Phys. Ed. 1. Gymnasium ...... | 1 | | |
| First Year Units ............. | 24 | Second Year Units .......... | 24 |

*Part of each term.

## SUMMARY OF WORK.

The several courses of study require the completion of units of work as follows:

| | Full Course | Special Course |
|---|---|---|
| Architectural subjects: | | |
| Drawing (including Graphics) .................. | 17 | 9 |
| History, Practice, Ethics, etc. .................. | 10 | 8 |
| Construction .................................. | 9 | 7 |
| Design ........................................ | 35 | 22 |
| Non-Architectural subjects ........................ | 25 | 2 |
| Total units required ............................. | 96 | 48 |

## COMBINED COURSE IN ARTS AND ARCHITECTURE.

Arch. 42, 43, 44, 45, 46, and any ten units in the following subjects may be offered toward both courses, viz.: Arch. 1, 2, 9, 10, 11, 12, 13, 21, 26, 27, 28, 29.

## GRADUATE WORK IN ARCHITECTURE.

Advanced instruction in Architecture is offered in a graduate course which, allowing wide latitude of choice among subjects of major interest, leads to the Master's degree. Its work may be completed in a single year or distributed over a longer period. While arranged primarily for the holder of a Bachelor's degree in Architecture equivalent to that of the University of Pennsylvania, other persons, where qualified, may be admitted to its subjects of study. Courses of study are arranged in consultation with the Professor of Architecture.

The candidate for a Master's degree must complete a minimum of twelve units. A unit is equivalent to one "standard course" in the Graduate School of the University; viz., a lecture course of one hour a week for one academic year. The time required for design and drawing courses varies from four hours, upward, per week, for each unit, as determined by the Professor in Charge. As in the Graduate School, the completion of this minimum requirement of twelve units confers no right upon the student to be recommended for the degree. This action will follow only on a favorable consideration of his achievement by the Faculty in Architecture.

The following groups are offered:

### I. ARCHITECTURAL DESIGN:

Major subject comprises the following:

| | | |
|---|---|---|
| Design (Numbered "Arch. Grad. 1") …… | 34 hours; | 8 units. |
| Drawing from Life (Arch. Grad. 31) …… | 4 hours; | 1 unit. |
| Water Color Rendering (Arch. Grad. 32) .. | 3 hours; | 1 unit. |

Minor subjects. One of the following is required:

| | | |
|---|---|---|
| History of Architecture (Arch. Grad. 21) .. | 2 hours; | 2 units. |
| History of Fine Arts (Arch. Grad. 22) …. | 2 hours; | 2 units. |
| Construction (Arch. Grad. 12) ………… | 2 hours; | 2 units. |

For students wishing both a History and a Construction course a special schedule of four hours work can be arranged.

II. ARCHITECTURAL HISTORY AND CRITICISM: Intended for those who desire preparation for research, teaching or criticism in the field of Architecture. The major work of the course will consist of graduate study in the history of architecture, painting and sculpture, supplemented by work in the philosophy of architecture; in ancient languages and history; and in drawing from the life and painting in water color, a total of twelve units of work.

III. ARCHITECTURAL CONSTRUCTION: For students who have not taken the Option in Advanced Architectural Construction of the Four-Year Course.

Major subject: Construction (including Arch. 37 to 41 inclusive) .................... 42 hours; 10 units.

Minor subject: Materials of Construction—Testing Laboratory (C. E. Nos. 35 to 37 inclusive) ........................... 2 hours; 2 units.

IV. ARCHITECTURAL CONSTRUCTION: For students who have taken the Option in Construction of the Four-Year Course.

Major subject: Construction (Arch. Grad. 11).. 42 hours; 10 units.

Minor subjects:

Design (Arch. Grad. 2) .................. 10 hours; 2 units.
or History (Arch. Grad. 21 or 22) ......... 2 hours; 2 units.

## THE COURSE IN CHEMISTRY.

### OFFICERS.

EDGAR F. SMITH, PH.D., CHEM.D., SC.D., L.H.D., LITT.D., LL.D., PROVOST; *Director of the* JOHN HARRISON *Laboratory of Chemistry.*

JOSIAH H. PENNIMAN, PH.D., LL.D., VICE-PROVOST.

HENRY B. EVANS, M.E., PH.D., DEAN OF THE TOWNE SCIENTIFIC SCHOOL.

| | |
|---|---|
| OWEN L. SHINN, PH.D., | *Chemistry.* |
| WALTER T. TAGGART, PH. D., | |
| THOMAS P. McCUTCHEON, JR., PH.D., | |
| JOHN FRAZER, A.M., PH.D., | |
| HIRAM S. LUKENS, PH.D., | |
| DANIEL L. WALLACE, CH.D., | |
| J. RAYMOND FITZPATRICK, A.M., | |
| JOHN H. MÜLLER, PH.D., | |
| *HERBERT S. HARNED, PH.D., | |
| NORMAN J. BRUMBAUGH, A.M., | |
| RALPH MAIR, B.S. in Ch. E., | |
| GEORGE W. BIRCH, B. S. in Ch., | |
| HARRY SELTZ, B.S. in Ch. E., | |
| CLARENCE L. SEN, B.S. in Ch. E., | |
| J. TRACEY LAY, B.S., | |
| EUGENE KOHN, B.S. in Ch. E., | |

The course in Chemistry extends over a period of four years, and leads to the degree of Bachelor of Science in Chemistry. The tuition fee is two hundred dollars ($200.00) a year.

The requirements for admission to this course are:

| Subjects | Units |
|---|---|
| English | 3 |
| History | 1 |
| Algebra | 1½ |
| Plane Geometry | 1 |
| Solid Geometry | ½ |
| Plane Trigonometry | ½ |
| Physics | ½ |
| Modern Foreign Language | 2 |
| Electives | 5 |
| Total | 15 |

---

*Absent on leave.

The two units of Modern Foreign Language may be German, French, Spanish or Italian, but both units must be in the same language.

### METHODS AND EQUIPMENT.

The work of the first term of the first year consists in the execution of a somewhat extended series of experiments upon the metals and non-metals. The student omits only those of greater difficulty, and such as require a skilled manipulator for their performance. In addition, he attends lectures and recitations, and solves numerous examples based upon the various reactions that he conducts practically. The skill and familiarity with chemical methods, acquired in this way will fully prepare him for the work of the second term, which is mainly analytical, as also is the first term of the Sophomore year, though considerable time is allotted to the preparation of a selected series of inorganic salts.

In quantitative analysis he is given every opportunity to familiarize himself with purely scientific methods in gravimetric, electrolytic and volumetric analysis; also with gas analysis, the use of the spectroscope, and the methods of technical analysis applied in the various branches of Chemistry. The instruction in Theoretical Chemistry is given by lectures; that in Applied Chemistry by lectures, supplemented by frequent visits to the chemical plants in Philadelphia and adjacent cities. The lectures and recitations in Organic Chemistry are conducted parallel with practical work in this subject. The aim is to have the student prepare typical substances from the whole field of Organic Chemistry. The most recent methods of analysis peculiar to this field receive due attention.

THE JOHN HARRISON LABORATORY OF CHEMISTRY provides a complete modern equipment for the prosecution of chemical studies, both undergraduate and graduate. A pamphlet containing plans of the Laboratory will be mailed upon application to the Director.

### FRESHMAN CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page. | Number |
| General Chemistry | 18 | — | 101 | Chem. 2 |
| Qualitative Analysis | — | 18 | 102 | " 4 |
| Algebra | 4 | — | 119 | Math. 31 |
| Analytic Geometry and Calculus | — | 4 | 119 | " 32 |
| German } only one required | 2 | 2 | 118 | Ger. 2 |
| | 1 | 1 | 118 | " 3 |
| French } | 2 | 2 | 116 | Fr. 2 |
| | 1 | 1 | 116 | " 3 |
| English Composition | 2 | 2 | 113 | Eng. 1 |
| English Literature | — | 2 | 114 | " 40 |
| Mechanical Drawing | 2 | — | 127 | M.E. 91 |
| Elements of Engineering | — | 2 | 127 | " 92 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 1 |

### SOPHOMORE CLASS.

| | | | | |
|---|---|---|---|---|
| Qualitative Analysis | 18 | — | 102 | Chem. 4 |
| Quantitative Analysis | — | 13 | 102 | " 7 |
| English Composition | 1 | 1 | 114 | Eng. 3 |
| English Literature | 2 | 2 | 115 | " 42-43 |
| German } only one required | 3 | 3 | 118 | Ger. 5-6-7 |
| Scientific German } | 2 | 2 | 118 | " 10 |
| French } | 3 | 3 | 116 | Fr. 4-5 |
| Scientific French } | 2 | 2 | 117 | " 8 |
| Mineralogy | 3 | 3 | 117 | Min. 1 |
| Physics | 6 | — | 128 | Physics 26 |
| Physics | — | 6 | 129 | " 27 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 2 |

### JUNIOR CLASS.

| | | | | |
|---|---|---|---|---|
| Quantitative Analysis | 13 | — | 102 | Chem. 7 |
| Organic Chemistry | 2 | 2 | 102 | " 9 |
| Assaying | 4 | 4 | 103 | " 17 |
| Physical Chemistry | 4 | 4 | 103 | " 21 |
| Inorganic Technical Analysis | — | 13 | 104 | " 22 |
| Philosophy of Nature | — | 2 | 127 | Phil. 5 |
| German } only one required | 2 | 2 | 119 | Ger. 11 |
| French } | 2 | 2 | 117 | Fr. 9 |
| English Literature | 2 | 2 | 115 | Eng. 91-90 |
| Mineralogy, Determinative | 2 | 2 | 117 | Min. 3 |
| Physics | 3 | 3 | 129 | Phys. 28 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 3 |

## SENIOR CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page | Number |
| Organic Chemistry | 3 | 3 | 102 | Chem. 10 |
| Practical Organic Chemistry | 10 | 10 | 102 | " 12 |
| Applied Chemistry | 2 | 2 | 103 | " 13 |
| Analysis of Foods | — | 8 | 103 | " 14 |
| Theoretical Chemistry | 1 | 1 | 103 | " 15 |
| Electro-Chemistry | 1 | 1 | 103 | " 16 |
| Practical Electro-Chemistry | 8 | — | 103 | " 19 |
| Geology | 3 | 3 | 117 | Geol. 3 |
| Business Law | 1 | 1 | 101 | Bus. Law 1 |
| English Literature | 2 | 2 | 115 | Eng. 62-64 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 4 |

## THE COURSE IN CHEMICAL ENGINEERING.

The Course in Chemical Engineering covers a period of four years, and leads to the degree of Bachelor of Science in Chemical Engineering. The tuition fee is two hundred dollars ($200.00) a year. Graduates who continue in the practice of their profession may receive the technical degree of Chemical Engineer under the provisions stated on page 43.

The chemical studies introduced into this course will not only give the student a thorough acquaintance with the fundamental principles of chemical science, but will also afford him a complete drill in analysis, and in the preparation of inorganic and organic products. Instruction in technical analysis and applied chemistry is reserved until the last year. Frequent excursions are made to adjacent plants for the purpose of studying practical processes in operation, and examining in detail the mechanical appliances in use.

The requirements for admission to this course are:

| Subjects | Units |
|---|---|
| English | 3 |
| History | 1 |
| Algebra | 1½ |
| Plane Geometry | 1 |
| Solid Geometry | ½ |
| Plane Trigonometry | ½ |
| Physics | ½ |
| Modern Foreign Language | 2 |
| Electives | 5 |
| Total | 15 |

The two units of Foreign Language may be German, French, Spanish or Italian but both units must be in the same language.

## FRESHMAN CLASS.

| Subjects | | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|---|
| | | 1st Term | 2d Term | Page | Number |
| General Chemistry | | 18 | — | 101 | Chem. 2 |
| Qualitative Analysis | | — | 14 | 102 | " 5 |
| Elementary Drawing | | 3 | 3 | 121 | M.E. 1 |
| Shop Work | | 6 | 6 | 121 | " 3-13 |
| English Composition | | 2 | 2 | 113 | Eng. 2 |
| English Literature | | — | 2 | 114 | " 41 |
| French | one only required | 2 | 2 | 116 | Fr. 2 |
| | | 1 | 1 | 116 | " 3 |
| German | | 2 | 2 | 118 | Ger. 2 |
| | | 1 | 1 | 118 | " 4 |
| Spanish | | 3 | 3 | 129 | Sp. 2 |
| Italian | | 3 | 3 | 119 | Ital. 2 |
| Trigonometry and Algebra | | 5 | — | 120 | Math. 35* |
| Algebra and Analytic Geometry | | — | 5 | 120 | " 36* |
| Physical Education | | 2 | 2 | 127 | Phys. Ed. 1 |

*Entering students who fail to pass the classifying examination in Mathematics M (see page 38) will take Math. 45 and 46, instead of 35 and 36, and must in addition obtain credit in Analytic Geometry before taking sophomore mathematics.

## SOPHOMORE CLASS.

| Subjects | | 1st Term | 2d Term | Page | Number |
|---|---|---|---|---|---|
| Analytical Chemistry (Qualitative) | | 14 | — | 102 | Chem. 5 |
| Analytical Chemistry (Quantitative) | | — | 10 | 102 | " 8 |
| Elements of Engineering | | 2 | — | 122 | M.E. 14 |
| Kinematics | | — | 3 | 122 | " 15 |
| Mechanical Drawing and Sketching | | 3 | 3 | 121 | " 11 |
| Shop Work* | | 3 | 6 | 122 | " 3-13 |
| English Composition | | 1 | — | 114 | Eng. 4 |
| English Literature | | — | 2 | 115 | " 42 |
| French | one only required | 2 | 2 | 116 | Fr. 6 |
| | | 1 | 1 | 116 | " 7 |
| German | | 2 | 2 | 118 | Ger. 8 |
| | | 1 | 1 | 118 | " 9 |
| Spanish | | 3 | 3 | 129 | Sp. 3-4 |
| Italian | | 3 | 3 | 119 | Ital. 3. |
| Calculus | | 4§ | — | 120 | Math. 39 |
| | | — | 4§ | 120 | Math. 40 |
| Physics | | 10† | — | 128 | Phys. 16-17 |
| Electricity and Magnetism | | — | 5‡ | 128 | Phys. 18 |
| Analytical Mechanics | | — | 5 | 128 | " 20 |
| Physical Education | | 2 | 2 | 127 | Phys. Ed. 2 |

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*Only for 1919-1920.
†Beginning with 1920-1921.
‡Given in first term in 1919-1920.
§Five hours in 1919-1920.

## JUNIOR CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page | Number |
| Analytical Chemistry (Quantitative). | 10 | — | 102 | Chem. 8 |
| Organic Chemistry .................. | 2 | 2 | 102 | " 9 |
| Assaying ........................... | — | 4 | 103 | " 18 |
| Physical Chemistry ................. | 4 | 4 | 103 | " 21 |
| Inorganic Technical Analysis ....... | — | 10 | 104 | " 23 |
| Mechanics of Materials ............. | 4 | — | 122 | M.E. 22 |
| Graphics ........................... | — | 3 | 126 | " 71 |
| Hydraulics ......................... | 2 | — | 122 | " 23 |
| Thermodynamics ..................... | — | 3 | 123 | " 28 |
| Mechanical Laboratory .............. | 3 | 3 | 123 | " 26 |
| Electrical Laboratory .............. | 3 | 3 | 112 | E.E. 32 |
| Elements of Electrical Engineering . | 4 | — | 112 | " 31 |
| Electrical Machinery ............... | — | 3 | 113 | " 33 |
| Physical Education.................. | 2 | 2 | 127 | Phys. Ed. 3 |

## SENIOR CLASS.

| | | | | |
|---|---|---|---|---|
| Organic Chemistry .................. | 3 | 3 | 102 | Chem. 10 |
| Practical Organic Chemistry ........ | 10 | 10 | 102 | " 12 |
| Applied Chemistry .................. | 2 | 2 | 103 | " 13 |
| Electro-Chemistry .................. | 1 | 1 | 103 | " 16 |
| Practical Electro-Chemistry ........ | 6 | — | 103 | " 20 |
| Organic Technical Analysis ......... | — | 6 | 103 | " 14 |
| Industrial Applications of Electricity.. | 3 | — | 113 | E.E. 41 |
| Electrical Laboratory .............. | 3 | — | 113 | " 42 |
| Power Plants ....................... | 4 | — | 124 | M.E. 46 |
| Applied Thermodynamics ............. | 2 | — | 126 | " 82 |
| Seminar ............................ | 1 | 1 | 124 | " 44 |
| Machine Design ..................... | — | 4 | 124 | " 41 |
| Mechanical Laboratory .............. | — | 3 | 126 | " 84 |
| Business Law ....................... | 1 | 1 | 101 | Bus. Law 1 |
| Physical Education.................. | 2 | 2 | 127 | Phys. Ed. 4 |

## THE COURSE IN CIVIL ENGINEERING.

### OFFICERS.

EDGAR F. SMITH, PROVOST.

JOSIAH H. PENNIMAN, PH.D., LL.D., VICE-PROVOST.

HENRY B. EVANS, M.E., PH.D., DEAN OF THE TOWNE SCIENTIFIC SCHOOL.

WILLIAM EASBY, JR., C. E., *Civil Engineering: Acting Professor in Charge.*

| | |
|---|---|
| **EDWARD L. INGRAM, C.E.,** | *Civil Engineering.* |
| **HERMAN C. BERRY, A.B., B.S. in C.E.,** | |
| WILLIAM C. H. SLAGLE, C.E., SC.D., | |
| EDWARD T. GRANDLIENARD, C.E., | |
| **WILLIAM S. PARDOE, B.A.SC.,** | |
| **WILLIAM T. LEGGO, C.E.,** | |
| **C. LAURENCE WARWICK, B.S. in C.E.,** | |
| BARTRAM A. OWEN, B.S. in C.E., | |
| JUDSON F. VODGES, JR., B.S. in C.E., | |
| ALEXANDER M. DICKEY, B.S. in C.E., | |

WILLIAM CLEVER.

The course in Civil Engineering extends over a period of four years, and leads to the degree of Bachelor of Science in Civil Engineering.

The tuition fee is two hundred dollars ($200.00) a year. Graduates who continue in the practice of their profession may receive the technical degree of Civil Engineer under the provisions stated on page 43.

The requirements for admission to this course are:

| **Subjects** | Units |
|---|---|
| English | 3 |
| History | 1 |
| Algebra | 1½ |
| Plane Geometry | 1 |
| Solid Geometry | ½ |
| Plane Trigonometry | ½ |
| Physics | ½ |
| Modern Foreign Language | 2 |
| Electives | 5 |
| Total | 15 |

The two units of Foreign Language may be German, French, Spanish, or Italian, but both units must be in the same language.

A combined course, requiring six years, of broader scope than the four-year course, is offered in the College and the Civil Engineering Department. Information concerning this course appears on page 53.

### METHODS AND EQUIPMENT.

The course in Civil Engineering is designed to meet, as thoroughly as practicable, the demands of engineering practice. The studies are sufficiently advanced and comprehensive to afford to the graduate that broad technical training essential to the successful prosecution of his subsequent professional work.

Text-books are used in general as a basis of instruction. Supplementary matter is given by lectures and in the form of notes. The aim is to keep the class work intimately in touch with the methods of current practice.

The equipment of surveying instruments includes two theodolites reading to single seconds by micrometer microscopes, two triangulation transits reading to twenty seconds, twelve engineers' transits, three precise levels, three dumpy levels, seven wye levels, two plane tables, three compasses, four sextants, and a large assortment of rods, tapes and minor instruments.

After the students have been made familiar with the adjustment and use of the various instruments, complete surveys are undertaken. During the first term a farm survey is made in connection with the regular weekly field practice. During the summer, two entire weeks are devoted to a topographic and hydrographic survey, and a like period to the survey of a railroad line. The data collected in the field serve as a basis for subsequent class-room instruction in the preparation of drawings and estimates.

The courses in the Theory of Stresses are supplemented by courses covering the practical application of the principles involved. Complete designs, accompanied by detail drawings, are made of a plate-girder and a pin-connected truss bridge. Similarly, the courses in the Theory of Hydraulics, Sanitary Engineering, Railroad Engineering and Masonry are followed by courses in the general design of a distributing system for a municipal water supply; the sewerage of a town; the elements of the design of railroad yards, terminals and track details; and the design of masonry structures.

The instruction relating to the Materials of Construction is supplemented by work in the Civil Engineering Testing Laboratories.

The largest machine in these laboratories has a capacity of 600,000 pounds. It is an Olsen vertical four-screw machine, of the universal type, capable of receiving a column twenty-four feet long, provided with beam extensions below the floor level twenty-one feet long designed for a load of 200,000 pounds on a span of twenty feet.

The remaining equipment consists of a 200,000-pound Olsen three-screw universal machine with beam extensions thirteen feet long, a 100,000-pound Olsen machine, two 30,000-pound Olsen machines, one 30,000-pound Falkenau-Sinclair machine, one 60,000-inch-pound torsion machine, an autographic pendulum torsion machine of the Thurston-Riehlé type, a 10,000-pound transverse machine, a cold-bend machine capable of bending a steel bar one square inch in section, a 15,000-pound wire-testing machine adapted also for receiving compression specimens up to a length of three feet, and a Turner-Hatt impact machine of 1,650 foot-pounds capacity with appliances for tension, compression, and bending tests. With the exception of the transverse, the wire-testing, and the pendulum-torsion machines designed for hand-operation, all of these machines are driven by independent electric motors.

These laboratories are further equipped with a great variety of special apparatus including two beam fiber extensometers; a Johnson and a Ewing extensometer, the latter reading to 1—5,000 of an inch; an Olsen compressometer reading to 0.0001 inch; two deflectometers; a complete set of strain gages reading to 0.0001 inch; a set of calibrating levers; standard weights; shearing apparatus for iron, steel and timber; besides a large assortment of micrometers, calipers, speed indicators and tools for the preparation and marking of specimens.

The Lesley Cement Laboratory is fully equipped for testing cement, sand, and plain and reinforced concrete. In contains four slate-top mixing tables each provided with a damp closet and scales.

The testing apparatus in this laboratory consists of an Olsen and a Riehlé machine of the lever type, a Fairbanks and a Falkenau-Sinclair machine of the shot type, and a 50,000-pound hand-power hydraulic machine for compression tests. It is further equipped with an Olsen mechanical briquette-molding machine, a Howard and Morse automatic sieve apparatus for cement and sand, a Bauschinger expansion apparatus, apparatus for accelerated tests, nine soapstone immersion tanks, cement bins, briquette racks, and a very complete outfit of smaller apparatus including balances, specific gravity apparatus, sieves, burettes, briquette molds, etc.

Special provision is made for work in concrete, including molds for beams up to thirteen feet long and a concrete immersion tank of suitable capacity for receiving these beams, a beam crane for their convenient handling and transportation, a concrete block for molding compression specimens, and storage bins for stone, sand, etc.

The brick laboratory contains two rattlers for testing paving brick, which may be operated singly or jointly by an electric motor.

A large and well-equipped laboratory is provided for instruction and research in hydraulics. The most important features of the installation are as follows:

A concrete reservoir of 23,000 gallons capacity, which receives the discharge from all apparatus and from which the laboratory supply is drawn by two electrically-driven two-stage turbine pumps, each with a capacity of 450 gallons per minute against a head of 165 feet; a low-lift centrifugal pump with a capacity of 2,000 gallons per minute; a 3-inch double-suction centrifugal pump with a capacity of 300 gallons per minute against a head of 60 feet; a vertical circular pressure tank, 5½ feet in diameter and 37 feet high, provided with attachments for orifices and other apparatus; a 12-inch standpipe 65 feet high with overflows to regulate the static head; circuits of 10-inch pipe, with numerous openings for the attachment of minor apparatus, connected with the standpipe and with the pressure tank; and two concrete weir tanks, each 34 feet long and 5 feet wide, which may be used also for measuring tanks. The latter may be converted into canals by opening the gates below the weir crests, for the purpose of investigating the flow over dams of various profiles. Two steel chutes are provided with valves operated by hydraulic cylinders to divert the flow alternately into two weighing tanks each of 16,000 pounds capacity, mounted on weighing cars, for weighing continuously the discharge from any part of the laboratory. The laboratory also contains a 9-inch reaction turbine, a 12-inch impulse wheel, water meters of various types, numerous gages and a great variety of minor apparatus.

A well-equipped machine shop is provided for making and repairing apparatus and for preparing test specimens. Considerable special apparatus adapted to the particular requirements of the different laboratories has been made in the shop, under the immediate supervision of the various professors. Some of this apparatus was especially designed for use in research work in connection with Senior theses.

Tours of inspection to manufacturing plants and to engineering works, completed or in course of construction, are made from time to time during the year by the Junior and Senior classes, but only in so far as they have a direct bearing on the work of the class room.

During the summer vacation following the Junior year, each student is required to prepare a memoir descriptive of some engineering work or manufacturing plant, based on his direct personal inquiries and observation.

A thesis on a professional subject is required of every candidate for a degree. These theses must embody either a design or a review of an engineering plant, process or structure, or the results of an experimental investigation. They must be fully illustrated by drawings and models when needed, and upon graduation must be deposited with the University.

The department library contains an excellent collection of the most recent technical works, supplementing the very complete collection of bound volumes of engineering journals and of the transactions of engineering societies in the Fairman Rogers collection. The leading technical journals are kept on file.

## THE COURSE IN CIVIL ENGINEERING.

### FRESHMAN CLASS.

| Subjects | | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|---|
| | | 1st Term | 2d Term | Page | Number |
| Descriptive Geometry | | 3 | 3 | 104 | C.E. 1 |
| Lettering | | 2 | — | 104 | " 2 |
| Freehand Drawing | | 2 | — | 104 | " 3 |
| Mechanical Drawing | | 2 | 2 | 104 | " 4 |
| Topographical Drawing | | — | 3 | 104 | " 6 |
| Trigonometry and Algebra | | 5 | — | 120 | Math. 35* |
| Algebra and Analytic Geometry | | — | 5 | 120 | " 36* |
| English Composition | | 2 | 2 | 113 | Eng. 2 |
| English Literature | | — | 2 | 114 | " 41 |
| German | only one required | 2 | 2 | 118 | Ger. 2 |
| | | 1 | 1 | 118 | " 4 |
| French | | 2 | 2 | 116 | Fr. 2 |
| | | 1 | 1 | 116 | " 3 |
| Spanish | | 3 | 3 | 129 | Sp. 2 |
| Italian | | 3 | 3 | 119 | Ital. 2 |
| Chemistry | | 8 | 8 | 101 | Chem. 1-3 |
| Physical Education | | 2 | 2 | 127 | Phys. Ed. 1 |

*Entering students who fail to pass the classifying examination in Mathematics M (see page 38) will take Math. 45 and 46, instead of 35 and 36, and must in addition obtain credit in Analytic Geometry before taking sophomore mathematics.

### SOPHOMORE CLASS.

| Subjects | | 1st Term | 2d Term | Page | Number |
|---|---|---|---|---|---|
| Mechanical Drawing | | 3 | 3 | 104 | C.E. 5 |
| Surveying, Theory | | 3 | — | 105 | " 10 |
| Surveying, Practice | | 3 | 3* | 105 | " 11 |
| Railroad Surveying, Theory | | — | 3 | 105 | " 12 |
| Railroad Surveying, Practice | | — | 3* | 105 | " 13 |
| Summer Surveying Practice | | 4 weeks vacation work | | 105 | " 14 |
| Calculus | | 4† | — | 120 | Math. 39 |
| | | – | 4† | 120 | " 40 |
| Physics | | 10‡ | — | 128 | Phys. 16-17 |
| Physics | | — | 5§ | 128 | " 18 |
| Analytic Mechanics | | — | 5 | 128 | " 20 |
| English Composition | | — | 1 | 114 | Eng. 4 |
| English Literature | | 2 | — | 115 | " 42 |
| German | only one required | 2 | 2 | 118 | Ger. 8 |
| | | 1 | 1 | 118 | " 9 |
| French | | 2 | 2 | 116 | Fr. 6 |
| | | 1 | 1 | 116 | " 7 |
| Spanish | | 3 | 3 | 129 | Sp. 3-4 |
| Italian | | 3 | 3 | 119 | Ital. 3 |
| Chemistry (Qualitative)‖ | | 4 | 4 | 101 | Chem. 3 |
| Physical Education | | 2 | 2 | 127 | Phys. Ed. 2 |

*For half of the term.
†Five hours in 1919-1920.
‖Only for 1919-1920.
‡Beginning with 1920-1921.
§Given in first term in 1919-1920.

### JUNIOR CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page | Number |
| Map Drawing | 2 | — | 105 | C.E. 7 |
| Railroad Construction and Maintenance | 2 | — | 105 | " 15 |
| Railroad Office Work | 2 | — | 106 | " 16 |
| Hydromechanics | 4 | — | 106 | " 25 |
| Hydraulic Testing | 3* | 3* | 106 | " 26 |
| Water-Supplies | — | 2 | 107 | " 27 |
| Sanitary Engineering | — | 2 | 107 | " 28 |
| Materials of Construction | — | 2 | 107 | " 35 |
| Materials Testing | 3* | 3* | 107 | " 36 |
| Mechanics of Materials | 5 | — | 107 | " 40 |
| Graphic Statics | — | 1 | 108 | " 41 |
| Framed Structures | — | 5 | 108 | " 42 |
| Bridge Design | — | 3 | 108 | " 44 |
| Masonry | 3 | — | 108 | " 46 |
| Astronomy | — | 3 | 101 | Astr. 2 |
| Geology | — | 2 | 117 | Geol. 9 |
| Mineralogy | 2 | — | 117 | Min. 6 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 3 |

### SENIOR CLASS.†

| Subjects | 1st Term | 2d Term | Page | Number |
|---|---|---|---|---|
| Railroad Economics | 2 | — | 106 | C.E. 17 |
| Railroad Design | 2 | — | 106 | " 18 |
| Geodesy, Theory | — | 2 | 106 | " 19 |
| Geodesy, Practice | — | 3 | 106 | " 20 |
| Hydraulic Works Design | 5 | — | 107 | " 29 |
| Roads and Pavements | 2 | — | 107 | " 30 |
| Cement Testing | 3 | — | 107 | " 37 |
| Framed Structures | 4 | — | 108 | " 43 |
| Bridge Design | 3 | 5 | 108 | " 45 |
| Masonry Design | — | 3 | 108 | " 47 |
| Reinforced Concrete | 4 | — | 108 | " 48 |
| Thesis | — | 6 | 109 | " 53 |
| Business Law | — | 2 | 101 | Bus. Law 1 |
| Applied Electricity | 3 | — | 113 | E.E. 51 |
| Steam Engines and Boilers | — | 4 | 127 | M.E. 93 |
| Physical Education | 2 | 2 | 127 | Phys. Ed. 4 |

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*For half of the class each term.

†A Summer Memoir is required for admission to full standing in the Senior Class. For a brief description, see page 109, number 52.

# THE COURSE IN ELECTRICAL ENGINEERING.

## OFFICERS.

EDGAR F. SMITH, PROVOST.
JOSIAH H. PENNIMAN, PH.D., LL.D., VICE-PROVOST.
HENRY B. EVANS, M.E., PH.D., DEAN OF THE TOWNE SCIENTIFIC SCHOOL.

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HAROLD PENDER, PH.D., *Electrical Engineering, Professor in Charge.*
C. E. CLEWELL, E.E., *Electrical Engineering.*
JESSE B. STRAW, B.S. in E.E., *Electrical Engineering.*
WILLET C. DUVALL, B.S. in E.E., *Electrical Engineering.*
RICHARD E. BROWN, *Electrical Engineering.*
JOSE DE A. COSTA, B.S. in E.E., *Electrical Engineering.*

The course in Electrical Engineering covers a period of four years, and leads to the degree of Bachelor of Science in Electrical Engineering.

Graduates of this course who continue in the practice of their profession receive the technical degree of Electrical Engineer three years after the Bachelor's degree has been conferred, upon presentation of an acceptable thesis. (See page 43.)

New students are admitted to advanced standing, provided they have pursued similar courses elsewhere.

The tuition fee for the courses in Electrical Engineering is two hundred dollars ($200.00) a year.

## SCOPE OF COURSES.

The instruction in the course in Electrical Engineering comprises lectures, recitations, laboratory practice, drafting, shopwork and excursions. Throughout the course emphasis is laid upon the application of fundamental principles to engineering problems. In general, the schedules are so arranged that one-half of each day is devoted to the work of the classroom and the other half to the more practical labors of the drawing room, the shop, and the laboratory.

The combination of lecture and recitation courses and practical work is designed to give the student such a fundamental knowledge of the apparatus and methods used in developing, transmitting and utilizing electric power, and in the allied branches of engineering, as will fit him to begin the pursuit of any one of the several branches of the Electrical Engineering profession.

The work of the first two years is the same in the Electrical Department as in the Mechanical Department, and consists largely of training in chemistry, physics, mathematics, and modern languages. During the Junior and Senior years the studies deal chiefly with the fundamentals of electrical engineering and their application in the design and performance of electrical apparatus, machinery and systems.

These subjects may be broadly classified under the heads of dynamo-electric machinery, distribution and transmission, electric railways, electric lighting, and industrial applications of electric power. In addition, instruction is given in the Senior and Junior years in those branches of mechanical engineering, heat engineering, hydraulic engineering and surveying which have a direct bearing on electrical engineering practice. Courses in business law and economics are also given.

### Excursions.

Throughout the four years, occasional visits are made to power plants and manufacturing establishments to enable the student to become familiar with the production and utilization of electric energy on a commercial scale.

During the Senior year at least one out-of-town excursion is made. Such an out-of-town trip is required of all Senior Students in Electrical Engineering. This required trip will take about one week, and the expense per student will probably range from $75.00 to $125.00, depending somewhat upon his personal expenditures.

### Equipment.

Instruction in technical subjects is given in the Engineering Building, which is exceptionally well equipped with the apparatus and facilities needed for instruction in Electrical Engineering.

A separate drawing room is assigned to each class, and a separate desk is assigned to each student as far as possible, no desk being occupied by more than two students. The drawing rooms are admirably lighted and are available for study purposes at all times during the day. All class rooms and drawing rooms are used jointly with the Department of Mechanical Engineering.

The electrical laboratories at present occupy three divisions of the Engineering Building. One is used for instruction in technical electrical measurements and in standardization work. Another is devoted to investigations of direct current generators, motors and railway equipment. The third division provides for work with alternating current machinery and for photometry.

### LIBRARY.

The Electrical, Mechanical and Civil Engineering Departments share a common library in the Engineering Building. This departmental library is well supplied with books, technical journals, and transactions of the leading engineering societies.

## THE COURSE IN ELECTRICAL ENGINEERING.

The requirements for admission to this course are as follows:

| Subjects | Units |
|---|---|
| English | 3 |
| History | 1 |
| Algebra | 1½ |
| Plane Geometry | 1 |
| Solid Geometry | ½ |
| Plane Trigonometry | ½ |
| Physics | ½ |
| Modern Foreign Language | 2 |
| Electives | 5 |
| Total | 15 |

The two units of Foreign Language may be German, French, Spanish, or Italian, but both units must be in the same language.

This course leads to the degree of B.S. in Electrical Engineering at the end of the Senior year. The technical degree of E.E. is conferred under the provisions stated on page 43.

## FRESHMAN CLASS.

| Subjects | | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|---|
| | | 1st Term | 2d Term | Page | Number |
| Mechanical Drawing | | 3 | 3 | 121 | M.E. 1 |
| Shop Work | | 6 | 3 | 121 | " 2 |
| Descriptive Geometry | | 3 | 3 | 121 | " 4 |
| English Composition | | 2 | 2 | 113 | Eng. 2 |
| English Literature | | — | 2 | 114 | " 41 |
| French | one only required | 3 | 3 | 116 | Fr. 2-3 |
| German | | 3 | 3 | 118 | Ger. 2-4 |
| Spanish | | 3 | 3 | 129 | Sp. 2 |
| Italian | | 3 | 3 | 119 | Ital. 2 |
| Trigonometry and Algebra | | 5 | — | 120 | Math. 35* |
| Algebra and Analytic Geometry | | — | 5 | 120 | " 36* |
| Chemistry | | 8 | 8 | 101 | Chem. 1-3 |
| Physical Education | | 2 | 2 | 127 | Ph. Ed. 1 |

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*Entering students who fail to pass the classifying examination in Mathematics M (see page 38) will take Mathematics 45 and 46, instead of 35 and 36, and must in addition obtain credit in Analytic Geometry before taking Sophomore Mathematics.

## SOPHOMORE CLASS.

| Subjects | | 1st Term | 2d Term | Page | Number |
|---|---|---|---|---|---|
| Mechanical Drawing and Sketching | | 3 | 3 | 121 | M.E. 11 |
| Shop Work and Shop Visits | | 6 | 6 | 122 | " 12 |
| Elements of Engineering | | 2 | — | 122 | " 14 |
| Kinematics | | — | 3 | 122 | " 15 |
| English Composition | | 1 | — | 114 | Eng. 4 |
| English Literature | | — | 2 | 115 | " 42 |
| French | one only required | 3 | 3 | 116 | Fr. 6-7 |
| German | | 3 | 3 | 118 | Ger. 8-9 |
| Spanish | | 3 | 3 | 129 | Sp. 3-4 |
| Italian | | 3 | 3 | 119 | Ital. 3 |
| Calculus | | 4* | — | 120 | Math. 39 |
| | | — | 4* | 120 | " 40 |
| Physics | | 10† | — | 128 | Phys. 16-17 |
| Analytic Mechanics | | — | 5 | 128 | " 20 |
| Physics | | — | 5‡ | 128 | " 18 |
| Chemistry§ | | 4 | 4 | 101 | Chem. 3 |
| Physical Education | | 2 | 2 | 127 | Ph.Ed. 2 |

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*Five hours in 1919-1920.
†Beginning with 1920-1921.
‡Given in first term in 1919-1920.
§Only for 1919-1920.

## JUNIOR CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page | Number |
| Kinematic Design Drawings | 3 | — | 122 | M.E. 21 |
| Mechanics of Materials | 4 | — | 122 | “ 22 |
| Hydraulics | 2 | — | 122 | “ 23 |
| Machine Design and Kinematic Design | 3 | 3 | 123 | “ 25 |
| Mechanical Laboratory | 3 | 3 | 123 | “ 26 |
| Thermodynamics | — | 3 | 123 | “ 28 |
| Graphics | — | 3 | 126 | “ 71 |
| Principles of Electrical Engineering | 5 | — | 110 | E.E. 1 |
| Electrical Measurements | 2 | 2 | 110 | “ 2 |
| Electrical Laboratory | 4 | 7 | 110 | “ 3 |
| Alternating Currents | — | 4 | 110 | “ 4 |
| Surveying, Theory and Practice | — | 3 | 109 | C.E. 61-62 |
| Differential Equations | 3 | — | 121 | Math. 43 |
| Physical Education | 2 | 2 | 127 | Ph. Ed. 3 |

## SENIOR CLASS.

| | | | | |
|---|---|---|---|---|
| Power Plants | 4 | — | 124 | M.E. 46 |
| Hydraulic Engineering | 2 | — | 126 | “ 81 |
| Heat Engineering | 2 | — | 126 | “ 82 |
| Mechanical Laboratory | 3 | 3 | 126 | “ 83 |
| Illumination | 2 | — | 110 | E.E. 11 |
| Seminar | 1 | 1 | 111 | “ 12 |
| Electric Power Plants | — | 3 | 111 | “ 13 |
| Electric Railways* | — | 3 | 111 | “ 14 |
| Motor Applications* | — | 3 | 111 | “ 15 |
| Distribution and Transmission | 2 | — | 111 | “ 16 |
| Alternating Current Machinery | 4 | 4 | 111 | “ 17 |
| Electric Machinery Laboratory | 7 | 4 | 112 | “ 18 |
| Thesis | — | 9 | 112 | “ 19 |
| Telegraphy and Telephony* | — | 3 | 112 | “ 20 |
| Business Law | 2 | — | 101 | B.L. 1 |
| Economics | — | 2 | 109 | E. of B. 1 |
| Physical Education | 2 | 2 | 127 | Ph. Ed. 4 |

* The student is required to elect two out of three of the Courses marked with an *

## THE COURSE IN MECHANICAL ENGINEERING.

### OFFICERS.

EDGAR F. SMITH, PROVOST.
JOSIAH H. PENNIMAN, PH.D., LL.D., VICE-PROVOST.
HENRY B. EVANS, M.E., PH.D., DEAN OF THE TOWNE SCIENTIFI SCHOOL.
ROBERT H. FERNALD, B.M.E., M.E., A.M., PH.D., *Dynamica Engineering: Professor in Charge.*
J. VERNE STANFORD, B.S., M.E., *Mechanical Engineering.*
GEORGE E. CROFOOT, B.S. in M.E., *Mechanical Engineering.*
FRANK D. CARVIN, B.S., in M.E., *Mechanical Engineering.*
ALOYSIUS F. ALLWEIN, B.S. in E.E., *Mechanical Engineering.*

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WILLIAM H. KAVANAUGH, M.E., *Experimental Engineering.*
GEORGE B. WHAREN, B.S., M.E., *Experimental Engineering.*
WILLIAM A. SLOAN, B.S. in M.E., *Experimental Engineering.*

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HORACE P. FRY, B.S. in E.E., *Mechanical Drawing.*
J. HORACE FRANK, B.S., *Mechanical Drawing.*
WALTER C. SETZER, *Mechanical Drawing.*

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JOHN J. MORRIS, *Mechanical Constructive Practice.*
GEORGE W. H. FAWKES, *Wood-working.*
PERCIVAL R. HALL, *Iron-working.*
CHARLES W. BLOEMKER, *Forging.*
JOHN F. MURPHY, *Iron Founding.*

The course in Mechanical Engineering covers a period of four years, and leads to the degree of Bachelor of Science in Mechanical Engineering.

Graduates of this course who continue in the practice of their profession receive the degree of Mechanical Engineer three years after the Bachelor's degree has been conferred, upon presentation of an acceptable thesis. (See page 43.)

New students are admitted to advanced standing, provided they have pursued similar courses elsewhere.

The tuition fee for the course in Mechanical Engineering is two hundred dollars ($200) a year.

A combined course, requiring six years, of broader scope than the four-year course, is offered in the College and the Mechanical Engineering Department. Information concerning this course appears on page 53.

## Scope of Course.

The instruction in the course in Mechanical Engineering comprises lectures, recitations, laboratory practice, drafting, shop-work and excursions. The time allotted is so arranged as to give the student a general acquaintance with the principles involved. In general, the schedules are so arranged that one-half of each day is devoted to the work of the class room and the other half to the more practical labors of the drawing room, the shop, and the laboratory.

The combination of lecture and recitation courses and practical work is designed to give the student such a fundamental knowledge of the apparatus and methods used in design and construction, and in developing, transmitting and utilizing power, that he will be able to take up after graduation any of the general divisions of Mechanical Engineering.

The work of the first two years consists largely of training in shop work, drawing, chemistry, physics, mathematics, and modern languages. During the Junior and Senior years the studies are almost purely technical in character and may be broadly classified under the heads of mechanics, thermodynamics, electrodynamics, design, power measurement and plant installation and equipment.

## Excursions.

Throughout the four years, occasional visits are made to the shops and manufacturing establishments of Philadelphia and vicinity to enable the student to become familiar with the progress of manufacturing, the arrangement of machinery and the mechanism of the machinery itself.

During the Senior year, at least one required out of town excursion is made. In the spring of 1919, the places visited included Pittsburgh, Cleveland, Akron, St. Louis, Keokuk, Chicago, Detroit and Niagara Falls.

The required trip for the spring of 1920 will take about two weeks. The expense involved by such excursions usually ranges from $75.00 to $110.00 for each student, depending somewhat upon his personal expenditures.

### EQUIPMENT.

Instruction in technical subjects is given in the Engineering Building, which is exceptionally well equipped for theoretical and practical instruction in Mechanical Engineering.

A separate drawing room is assigned to each class, and a separate desk is assigned to each student as far as possible, no desk being occupied by more than two students. The rooms are admirably lighted and are available for study purposes at all times during the day.

The mechanical laboratory, located on the first floor, is divided into sections devoted to the investigation of problems in hydraulics, materials of construction, gas engineering, boiler testing, refrigeration, heating and ventilation, and steam engineering.

The shops consist of a forge shop, foundry, iron-working and pattern shops with complete equipment.

### LIBRARY.

The Mechanical, Electrical and Civil Engineering Departments share a common library in the Engineering Building. This departmental library is well supplied with books, technical journals, and transactions of the leading engineering societies.

## THE COURSE IN MECHANICAL ENGINEERING.

The requirements for admission to this course are as follows:

| Subjects | Units |
|---|---|
| English | 3 |
| History | 1 |
| Algebra | 1½ |
| Plane Geometry | 1 |
| Solid Geometry | ½ |
| Plane Trigonometry | ½ |
| Physics | ½ |
| Modern Foreign Language | 2 |
| Electives | 5 |
| Total | 15 |

The two units of Foreign Language may be German, French, Spanish, or Italian, but both units must be in the same language.

This course leads to the degree of B.S. in Mechanical Engineering at the end of the Senior year. The technical degree of M. E. is conferred under the provisions stated on page 43.

### FRESHMAN CLASS.

| Subjects | | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|---|
| | | 1st Term | 2d Term | Page | Number |
| Mechanical Drawing | | 3 | 3 | 121 | M.E. 1 |
| Shop Work | | 6 | 3 | 121 | “ 2 |
| Descriptive Geometry | | 3 | 3 | 121 | “ 4 |
| English Composition | | 2 | 2 | 113 | Eng. 2 |
| English Literature | | — | 2 | 114 | “ 41 |
| French | | 3 | 3 | 116 | Fr. 2-3 |
| German | one only | 3 | 3 | 118 | Ger. 2-4 |
| Spanish | required | 3 | 3 | 127 | Sp. 2 |
| Italian | | 3 | 3 | 119 | Ital. 2 |
| Trigonometry and Algebra | | 5 | — | 120 | Math. 35* |
| Algebra and Analytic Geometry | | — | 5 | 120 | “ 36* |
| Chemistry | | 8 | 8 | 101 | Chem. 1-3 |
| Physical Education | | 2 | 2 | 127 | Ph. Ed. 1 |

*Entering students who fail to pass the classifying examination in Mathematics M (see page 38) will take Math. 45 and 46, instead of 35 and 36, and must in addition obtain credit in Analytic Geometry before taking Sophomore Mathematics.

### SOPHOMORE CLASS.

| Subjects | | 1st Term | 2d Term | Page | Number |
|---|---|---|---|---|---|
| Mechanical Drawing and Sketching | | 3 | 3 | 121 | M.E. 11 |
| Shop Work and Shop Visits | | 6 | 6 | 122 | “ 12 |
| Elements of Engineering | | 2 | — | 122 | “ 14 |
| Kinematics | | — | 3 | 122 | “ 15 |
| English Composition | | 1 | — | 114 | Eng. 4 |
| English Literature | | — | 2 | 115 | “ 42 |
| French | | 3 | 3 | 116 | Fr. 6-7 |
| German | one only | 3 | 3 | 118 | Ger. 8-9 |
| Spanish | required | 3 | 3 | 129 | Sp. 3-4 |
| Italian | | 3 | 3 | 119 | Ital. 3 |
| Calculus | | 4* | — | 120 | Math. 39 |
| | | — | 4* | 120 | “ 40 |
| Physics | | 10† | — | 128 | Phys. 16-17 |
| Physics | | — | 5‡ | 128 | “ 18 |
| Analytic Mechanics | | — | 5 | 128 | “ 20 |
| Chemistry§ | | 4 | 4 | 101 | Chem. 3 |
| Physical Education | | 2 | 2 | 127 | Ph. Ed. 2 |

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*Five hours in 1919-1920.

†Beginning with 1920-1921.

‡Given in first term in 1919-1920.

§Only for 1919-1920.

## JUNIOR CLASS.

| Subjects | Number of hours a week | | For a brief description, see | |
|---|---|---|---|---|
| | 1st Term | 2d Term | Page | Number |
| Kinematic Design Drawings | 3 | — | 122 | M.E. 21 |
| Mechanics of Materials | 4 | — | 122 | " 22 |
| Hydraulics | 2 | — | 122 | " 23 |
| Seminar | 1 | 1 | 123 | " 24 |
| Machine Design and Kinematic Design | 3 | 3 | 123 | " 25 |
| Mechanical Laboratory | 3 | 3 | 123 | " 26 |
| Graphics | — | 5 | 123 | " 27 |
| Thermodynamics | — | 3 | 123 | " 28 |
| Elements of Electrical Engineering | 4 | — | 112 | E.E. 31 |
| Electrical Laboratory | 3 | 3 | 112 | " 32 |
| Electric Machinery | — | 3 | 113 | " 33 |
| Surveying, Theory and Practice | — | 3 | 109 | C.E. 61-62 |
| Physical Education | 2 | 2 | 127 | Ph. E. 3 |

## SENIOR CLASS.

| | | | | |
|---|---|---|---|---|
| Machine Design | 4 | — | 124 | M.E. 41 |
| Hydrodynamics | 2 | — | 124 | " 42 |
| Heat Power Engineering | 3 | — | 124 | " 43 |
| Seminar | 1 | 1 | 124 | " 44 |
| Mechanical Laboratory | 7 | 2 | 124 | " 45 |
| Power Plants | — | 4 | 124 | " 46 |
| Thesis | — | 9 | 125 | " 47 |
| Inspection Trip | — | — | 125 | " 48 |
| Steam Engine* | 3 | — | 125 | " 51 |
| Steam Turbine | — | 3 | 125 | " 52 |
| Steam Machinery Design* | — | 4 | 125 | " 53 |
| Heating and Ventilation | 3 | — | 125 | " 54 |
| Internal Combustion Engine* | 3 | — | 125 | " 55 |
| Manufacture and Distribution of Gas | — | 2 | 126 | " 56 |
| Gas Engineering Design* | — | 4 | 126 | " 57 |
| Industrial Applications ot Electricity | 3 | — | 113 | E.E. 41 |
| Electric Machinery Laboratory | 3 | — | 113 | " 42 |
| Business Law | 2 | — | 101 | B.L. 1 |
| Economics | — | 2 | 109 | E. of B. 1 |
| Option | — | 2 | —— | |
| Physical Education | 2 | 2 | 127 | Ph. Ed. 4 |

*First term. Student may elect M.E. 51 or M.E. 55. Second term. Student may elect M.E. 53 or M.E. 57.

## SUMMER SCHOOL.

**A special circular, containing a full description of the courses to be offered in 1919, may be had upon application to the Director of the Summer School, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.**

## SUBJECTS OF INSTRUCTION

OFFERED BY THE FACULTY OF

## THE TOWNE SCIENTIFIC SCHOOL.

Architecture.
Astronomy.
Business Law.
Chemistry.
Civil Engineering.
Economics.
Electrical Engineering.
English.
French.
Geology.
Germanic Languages.
History.
Hygiene.
Italian.
Mathematics.
Mechanical Engineering.
Military Training.
Mineralogy.
Philosophy.
Physical Education.
Physics.
Spanish.

## ARCHITECTURE.

Architecture 1. *Design.*—Grade I. Problems in elementary design involving the use of the elements. These problems are co-ordinated to the lectures in 9 and 10. One unit. Eight hours. Mr. Bacon.

Architecture 2. *Design.*—Grade II. Exercises in architectural composition and in rendering, involving the application of the principles of architectural drawing. Four units. Eighteen hours. Mr. McGoodwin.

Architecture 3. *Design.*—Grade III. Problems in elementary design of the small ensemble and in the design of architectural motifs; two to four weeks each. Four units. Eighteen hours. Mr. McGoodwin.

Architecture 4. *Design.*—Grade IV. Problems in the design of component motifs of architectural composition, and the design of the ensemble; three to four weeks each. Sketch problems in decorative architecture. Five units, twenty-four hours. Assistant Professor Bickley, Mr. McGoodwin.

Architecture 5. *Design.* Grade V. Problems in the design of component motifs of architectural composition and the design of the ensemble, three to five weeks each. Sketch problems in decorative architecture. Five units, twenty-four hours. Assistant Professor Bickley.

Architecture 6. *Design.*—Grade VI. Problems in the composition of the ensemble four to five weeks each; in plan composition, and in the composition of interiors. One-day sketch problems in plan composition. Fourteen units. Thirty-two hours. Assistant Professor Bickley and Acting Professor Wynkoop.

*Design Judgments.*—During the year of 1917-18, the following architects served in judgments upon the work in design by the upper classes of the School; namely, Messrs.:

G. H. Bickley,
Paul A. Davis,
Leicester B. Holland,
R. R. McGoodwin,
John Wynkoop
Edgar V. Seeler,
Howell L. Shay,
W. T. Karcher.

ARCHITECTURE 9 and 10. *The Elements of Architecture.*—(9) Lectures on the Five Orders, their affiliated forms and derivatives and other elements of Renaissance design, accompanied by exercises in drawing and rendering. (10) Lectures on Architectural Features, Wall Treatments, Arches, Vaults, etc., treated with reference to their employment in Architectural Composition. The problems in Grade I Design are co-ordinate to these lectures. Course 9, one and one-half units, two hours, PROFESSOR LAIRD. *Drawing,* MR. BIEBER. Course 10, one-half unit, one hour, MR. BACON. Total lectures and drawing, eight hours, for 9 and 10.

ARCHITECTURE 11 and 12. *Freehand Drawing.*—Grades I and II. Outline representations of simple objects, in groups, as exercises in developing the powers of observation as well as in the training of the hand. Elementary drawing in charcoal from grouped objects and from casts, etc., as exercises in representations of the third dimension. Grades I and II, each one unit, each four hours, PROFESSOR DAWSON and assistants.

ARCHITECTURE 13 and 14. *Freehand Drawing.*—Grades III and IV. Drawing in charcoal from casts of architectural ornament, architectural fragments, and parts of the figure. Grades III and IV, each one unit, each four hours, PROFESSOR DAWSON and assistants.

ARCHITECTURE 15. *Freehand Drawing.*—Grade V. Charcoal drawing from reproductions of antique figures. One unit. Four hours. PROFESSOR DAWSON and assistants.

ARCHITECTURE 16. *Freehand Drawing from the Life.*—Grade VI. Two units. Four hours. PROFESSOR EVERETT.

ARCHITECTURE 20. *Historic Ornament.*—From motifs in historic ornament, involving composition. One unit. Four hours. PROFESSOR EVERETT.

ARCHITECTURE 21 and 22. *Water-Color Drawing.*—Grades I and II. Exercises in the handling of the medium and in translation of color. Grades I and II, each one unit, each three hours, PROFESSOR DAWSON.

ARCHITECTURE 23 and 24. *Water-Color Rendering.*—Grades III and IV. Studies in rendering: First, of architectural objects; second, of photographic subjects. Grades III and IV, each one unit, each three hours, PROFESSOR DAWSON.

ARCHITECTURE 26. *Architectural Drawing.*—Exercises in (*a*) instrumental drawing, (*b*) pen and pencil drawing, (*c*) brush work, and (*d*) lettering; with particular application to architectural subjects. One unit. Twelve hours. MR. BACON.

ARCHITECTURE 27. *Descriptive Geometry.*—Orthographic projections; revolutions; single and double curved surfaces of revolution; intersections of lines, planes and solids; tangents and developments. Lectures and exercises. Two units. Six hours. ASSISTANT PROFESSOR WHITNEY and assistants. (The subjects of shades and shadows and perspective are separately treated, as follows.)

ARCHITECTURE 28. *Shades and Shadows.*—Lectures and exercises, with especial emphasis upon the theory of Descriptive Geometry as involved in problems relating particularly to architectural practice. One unit. Three hours. ASSISTANT PROFESSOR WHITNEY and assistants.

ARCHITECTURE 29. *Perspective.*—Lectures and exercises, with especial emphasis upon the theory of Descriptive Geometry and Shades and Shadows as involved in problems relating particularly to architectural practice. One unit. Six hours. ASSISTANT PROFESSOR WHITNEY and assistants.

ARCHITECTURE 30. *Mechanics of Architectural Construction.*—Nature, properties and strength of the materials used in architectural construction; special application of the principles of mechanics to buildings and structural parts of buildings, such as beams, girders, columns, trusses, arches, etc. Two units. Five hours. PROFESSOR NOLAN.

ARCHITECTURE 31. *Graphic Statics in Architecture.*—Special applications of graphic methods to the analysis of stresses in different kinds of architectural construction, such as beams, trusses, piers, arches, abutments, etc., and investigations relating to the stability of buildings and structural parts of buildings. Two units. Seven hours. MR. BACON.

ARCHITECTURE 32. *Carpentry.*—Nature and properties of woods used in buildings. Carpentry, heavy framing and mill-construction. Lectures and drawing. (32 and 33 form a two-year course, 33 being given in 1918-19.) Two units. Three hours. MR. BACON.

ARCHITECTURE 33. *Masonry and Ironwork.*—Nature and properties of materials used in masonwork. Masonry and ordinary foundations; ironwork and steelwork; concrete work. Lectures and drawing (32 and 33 form a two-year course, 32 being given in 1919-20). Two units. Three hours. MR. BACON.

ARCHITECTURE 34 and 35. *Building Sanitation.*—34, Heating and Ventilation; 35, Plumbing and Drainage. Preceded by Hygiene 1. Scientific principles of Sanitary Engineering and their application in building-practice. . One unit. PROFESSOR NOLAN.

ARCHITECTURE 36. *Strength of Materials.*—The elementary principles of the mechanics of materials used in carpentry, masonry and ironwork. Lectures and problems adapted to the special students. Practice in the use of architects' and engineers' handbooks. Two units. Three hours. PROFESSOR NOLAN.

The following subjects (37, 38, 39, 40, 41), together with those numbered C. E. 37, 48, 65, constitute the Option in Advanced Archtectural Construction.

ARCHITECTURE 37. *Architectural Construction: Design; Grade B.*—Practical problems of four to five weeks each in architectural, constructive design. Buildings designed and analyzed as structural units and the details in each problem carefully worked out. The subject of these problems is usually the building just designed by the students in Grades IV and V, Design. Six units. Twenty-six hours. PROFESSORS NOLAN and BICKLEY.

ARCHITECTURE, 38. *Architectural Construction: Design; Grade A.*—Either a further development of course 37, as explained, or an extended problem in architectural constructive design, consisting of a subject chosen by the student with the approval of the Professor of Architecture, descriptive memoir and specification accompanying the design. Six units. Twenty-six hours. PROFESSORS NOLAN and BICKLEY.

ARCHITECTURE 39. *Architectural construction: Theory.*—Typical skeleton structures. Plans of column, girder and beam-framing. Details of framed metal connections. Plate girders and box girders. Wind-bracing. Truss-design and details. Latest fireproofing methods. Reinforced concrete construction. Four units. Six hours. PROFESSOR NOLAN.

ARCHITECTURE 40. *Foundations of Buildings.*—Consideration of special problems relating to foundations for heavy buildings. Pile foundations. Grillage. Masonry wells and caissons. Cantilever foundations. Foundations under water. One unit. Three hours. PROFESSOR NOLAN.

ARCHITECTURE 41. *Specifications, Estimates and Contracts.*—General and special clauses of architects' specifications for the different kinds of material and labor. Forms of contracts and their relations to building operations. Examinations and comparison of typical and model forms. Practice in writing specifications. Methods of estimating cost of labor and materials for the different kinds of architectural construction. One unit. Three hours. PROFESSOR NOLAN.

ARCHITECTURE 42. *Ancient Architectural History.*—From the prehistoric age to the fall of the Roman Empire. Lectures, two hours; research, one hour. One and one-half units. ASSISTANT PROFESSOR GUMAER.

ARCHITECTURE 43. *Medieval Architectural History.*—From the fall of the Roman Empire to the Fifteenth Century. Lectures, two hours; research, one hour. One and one-half units. ASSISTANT PROFESSOR GUMAER.

ARCHITECTURE 44. *History of Renaissance and Modern Architecture.*—From Brunelleschi to the close of the Nineteenth Century. Lectures, two hours first term; one hour second term. Research additional. Two units. ASSISTANT PROFESSOR GUMAER.

ARCHITECTURE 45. *History of Painting.*—A course of lectures upon the history of painting. One unit. One hour. PROFESSOR EVERETT.

ARCHITECTURE 46. *History of Sculpture.*—A course of lectures upon the history of sculpture. One unit. One hour. PROFESSOR EVERETT.

ARCHITECTURE 47. *Professional Ethics and Practice.*—Aspects and problems of practice; professional ethics, competitions, preliminary cost computations, utilities in the planning of schools, libraries, court-houses, etc., etc. Lectures and research. One unit. One hour. PROFESSOR LAIRD.

ARCHITECTURE 48. *Special Lectures on Architectural and Allied Subjects.* One unit. One hour. Lecturers and subjects 1917-18 as follows:

*Decorative Art.*—(1), Alfred H. Gumaer, Assistant Professor of Architectural History.

*Stained Glass.*—(1), Lawrence Saint, Stained Glass Designer.

*Japanese Architecture.*—(3), Warren P. Laird, Professor of Architecture.

*The Human Figure in Art.*—(2), R. Tait McKenzie, M.D., Professor of Physical Education.

*Concrete.*—(4), Emile G. Perrot, Architect and Engineer.

*Crete, Ancient, Medieval and Modern.*—(1), S. B. Luce, of the University Museum.

*Original American Architecture.*—(1), Dr. George B. Gordon, Director University Museum.

*Quarrying of Stone.*—(1), Frank Hoyt, Editor, New York.

*Illumination.*—(2), C. E. Clewell, Assistant Professor of Electrical Engineering.

*Stonework.*—(1), Horace Wells Sellers, Architect, Philadelphia.

*The Relation of Plastic Decoration to Architecture.*—(1), Joseph H. Bass, Decorative Sculptor.

*Stained Glass.*—(2), Leicester B. Holland, Instructor in Design.

*Lithography and Art for Architects.*—(2), Joseph Pennell, Artist.

*Nature of Stone.*—(1), Frederick Ehrenfeld, Assistant Professor of Geology and Mineralogy.

*The Philadelphia Parkway.*—(1), Jacques Greber, Landscape Architect, Paris.

*Structural Service.*—(2), D. Knickerbocker Boyd, Architect.

*Architecture in Peace and War.*—(1), Harvey Maitland Watts, Art Critic.

ARCHITECTURE 49. *Composition and the Theory of Design.*—A review of the basic principles of design followed by an analytical study of the compositions of noted plans and buildings, ancient and modern, and extended by discussion of the current problems in design. Lectures. One unit. One hour. ACTING PROFESSOR WYNKOOP.

### GRADUATE INSTRUCTION IN ARCHITECTURE.

For description of courses, see pages 69, 70.

## ASTRONOMY.

ASTRONOMY 2. *Astronomy.*—Young's *Manual of Astronomy.* Prerequisites, Mathematics 1 and 2. Three hours. Second term. One and a half units. PROFESSOR DOOLITTLE and ASSISTANT PROFESSOR BARTON.

ASTRONOMY 3. *Practical Astronomy.*—Doolittle's *Practical Astronomy.* Prerequisite, Astronomy 2. Three hours. Second term. One and a half units. PROFESSOR DOOLITTLE.

## BUSINESS LAW.

BUSINESS LAW 1. The law and principles of contracts, negotiable instruments, agency, partnerships, corporations, and the sale and transfer of real and personal property, and the discussion of forms and problems thereunder. One hour, both terms, or two hours, one term. MR. LICHTENBERGER.

## CHEMISTRY.

CHEMISTRY 1. *General Inorganic Chemistry.*—Recitation, conversational lectures and laboratory work. Experiments illustrating the principles of Chemistry. Four hours lecture and recitation and four hours laboratory. First term. Three units. PROFESSOR SMITH, ASSISTANT PROFESSOR MCCUTCHEON, ASSISTANT PROFESSOR FRAZER, MR. FITZPATRICK, MR. BRUMBAUGH, MR. SELTZ, MR. LAY.

CHEMISTRY 2. Same as 1. Given in greater detail. Intended for students pursuing chemistry as a major subject. One hour lecture, five hours recitation and twelve hours laboratory. First term. PROFESSOR SMITH, ASSISTANT PROFESSOR MCCUTCHEON, ASSISTANT PROFESSOR FRAZER, MR. FITZPATRICK, MR. BRUMBAUGH.

CHEMISTRY 3. *Analytical Chemistry.*—Qualitative Analysis. Laboratory practice with lectures and recitations. Prerequisite, Chemistry 1. Four hours lecture and recitation and four hours laboratory. Second term. Three units. PROFESSOR SMITH, DR. MÜLLER, MR. SELTZ.

CHEMISTRY 4. This course is to 3 what 2 is to 1. For Chemists. Prerequisite, Chemistry 2. Three hours lecture and recitation and fifteen hours laboratory. Both terms. PROFESSOR SMITH, DR. MÜLLER, MR. SELTZ.

CHEMISTRY 5. Similar to 4. For Chemical Engineers. Prerequisite, Chemistry 2. Three hours lecture and recitation. Eleven hours laboratory. Both terms. PROFESSOR SMITH, DR. MÜLLER, MR. SELTZ.

CHEMISTRY 6. *Analytical Chemistry.*—Quantitative Analysis. Gravimetric and volumetric analysis, with drill in mineral analysis. Prerequisite, Chemistry 3. One hour lecture and four hours laboratory. Both terms. Three units. PROFESSOR SMITH, DR. WALLACE.

CHEMISTRY 7. Same as 6. Intended for students pursuing chemistry as a major subject. Prerequisite, Chemistry 4. One hour lecture and twelve hours laboratory. Both terms. PROFESSOR SMITH, DR. WALLACE.

CHEMISTRY 8. Same as 7. Intended for Chemical Engineering students. Prerequisite, Chemistry 5. One hour lecture and nine hours laboratory. Both terms. PROFESSOR SMITH, DR. WALLACE.

CHEMISTRY 9. *Organic Chemistry* (Elementary Course).—Illustrated lecture course, preliminary to 10. It is intended to give the student a general knowledge of the carbon compounds. Special attention is paid to practical application. Must be preceded or accompanied by Chemistry 7 or 8. Two hours. Both terms. PROFESSOR TAGGART.

CHEMISTRY 10. *Organic Chemistry* (Advanced).—Must be preceded by 9. Three hours. Both terms. PROFESSOR TAGGART..

CHEMISTRY 11. *Organic Chemistry* (Minor Course).—Lectures, recitations and laboratory work. Prerequisite, Chemistry 3. One hour recitation and four hours laboratory. Both terms. Three units. PROFESSOR TAGGART.

CHEMISTRY 12. *Practical Organic Chemistry.*—Preparation and study of a series of typical organic compounds, together with their qualitative and ultimate analysis. Must be accompanied by Chemistry 10. Ten hours. Both terms. PROFESSOR TAGGART.

CHEMISTRY 13. *Applied Chemistry.*—Lectures upon subjects pertaining both to Inorganic and Organic Chemistry, supplemented by regular excursions to chemical plants. Prerequisite, Chemistry 9 or 11. Two hours. Both terms. PROFESSOR SHINN.

CHEMISTRY 14. *Analysis of Foods and Technical Products.*—Analysis of milk, butter, bread, honey, coffee, chocolate, sugar (with the use of the polariscope), pepper, water, soaps, lubricating oils, paints, tanning materials, etc., etc. Lectures and recitations, with practical exercises. Prerequisites. Chemistry 6 and 9. Two hours lecture and six hours laboratory. Second term. PROFESSOR TAGGART.

CHEMISTRY 15. *Theoretical Chemistry.*—Lectures and recitations. Prerequisites, Chemistry 6 and 9. One hour. Both terms. PROFESSOR SMITH.

CHEMISTRY 16. *Electro-Chemistry.*—Lectures, setting forth the theoretical side of the subject, with applications of the electric current to analysis, and to the preparation of chemical products. Prerequisite, Chemistry 6. One hour. Both terms. PROFESSOR SMITH, ASSISTANT PROFESSOR LUKENS.

CHEMISTRY 17. *Assaying.*—Gold, silver, lead, iron, copper and coal assays. Lectures and laboratory. Must be accompanied or preceded by Chemistry 6. One hour lecture and three hours laboratory. Both terms. PROFESSOR SHINN.

CHEMISTRY 18. Same as 17. Intended for Chemical Engineering students. One hour lecture and three hours laboratory. Second term. PROFESSOR SHINN.

CHEMISTRY 19. *Practical Electro-Chemistry.*—Laboratory for Chemists. Must be accompanied by Chemistry 16. Eight hours. First term. PROFESSOR SMITH, ASSISTANT PROFESSOR LUKENS.

CHEMISTRY 20. *Practical Electro-Chemistry.*—Laboratory for Chemical Engineers. Must be accompanied by Chemistry 16. Six hours. First term. PROFESSOR SMITH, ASSISTANT PROFESSOR LUKENS.

CHEMISTRY 21. *Physical Chemistry.*—Lectures, one hour a week, dealing with relations between theories and facts, as well as with the properties, and phase and energy relations of matter. Laboratory, three hours a week, measurement of densities of gases and liquids, boiling points, freezing points, practice with spectrometer, polarimeter, refractometer and various physico-chemical apparatus. Prerequisite, Chemistry 7. One hour lecture and three hours laboratory. Both terms. MR. KOHN.

CHEMISTRY 22. *Inorganic Technical Analysis.*—Analysis of furnace gas, cement, fertilizers, bleaching materials, etc. Prerequisite, Chemistry 7. One hour lecture and twelve hours laboratory. Second term. PROFESSOR SHINN.

CHEMISTRY 23. Same as 22. For Chemical Engineers. Prerequisite, Chemistry 8. One hour lecture and nine hours laboratory. Second term. PROFESSOR SHINN.

## CIVIL ENGINEERING.

CIVIL ENGINEERING 1. *Descriptive Geometry.*—Elementary plane problems. Problems of the point, line and plane; single-curved, double-curved and warped surfaces. Shades and shadows. Isometric drawing and perspective. Three hours. Both terms. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 2. *Lettering.*—Freehand lettering. Two hours. First term. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 3. *Freehand Drawing.*—Lines and figures on plane surfaces; objects in freehand projection. Two hours. First term. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 4. *Mechanical Drawing.*—Drafting instruments and operations; elementary projection; line shading; coloring; graining; representation of earthwork and masonry. Two hours. Both terms. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 5. *Mechanical Drawing.*—Drawings based on sketches and measurements of objects. Prerequisite, Civil Engineering 4. Three hours. Both terms. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 6. *Topographical Drawing.*—Conventional methods of representation in ink and in color. Elementary exercises. Three hours. Second term. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 7. *Map Drawing.*—Map of hydrographic and topographic survey made during the previous summer. Prerequisite, Civil Engineering 11. Two hours. First term. ASSISTANT PROFESSOR SLAGLE.

CIVIL ENGINEERING 10. *Surveying: Theory.*—Theory relating to the use and adjustments of the instruments; theory of topographic, hydrographic, mining and city surveying. Three hours. First term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 11. *Surveying: Practice.*—Practice in the adjustment and use of field and office instruments, including a special farm survey which is made during the first term. Concurrent with Civil Engineering 10. Three hours, first term. Three hours, half of second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 12. *Railroad Surveying: Theory.*—Simple, compound, reversed and transition curves. Turnouts and switches. Theory of the computation of earthwork. Prerequisites, Civil Engineering 10, Civil Engineering 11. Three hours. Second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 13. *Railroad Surveying: Practice.*—Practice in staking out curves, cross-sectioning, setting of slope stakes, etc. Prerequisites, Civil Engineering 10, Civil Engineering 11. Concurrent with Civil Engineering 12. Three hours. Half of second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 14. *Summer Surveying Practice.*—At the end of the second term two weeks are devoted to an extended topographic and hydrographic survey; and two weeks to field practice in laying out a short line of railroad, including reconnaissance, preliminary survey, location, determination of grades, cross-sectioning, drawing of the map and profile. Prerequisites, Civil Engineering 11, Civil Engineering 13. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 15. *Railroad Construction and Maintenance.*—Maintenance of railway track and structures. Rolling stock, signaling, etc. Prerequisites, Civil Engineering 12, Civil Engineering 13. Two hours. First term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 16. *Railroad Office Work.*—Computation and distribution of earthwork. Paper location of a line of railroad; construction of the profile; estimates of quantities and cost. Prerequisites, Civil Engineering 12, Civil Engineering 13. Concurrent with Civil Engineering 15. Two hours. First term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 17. *Railroad Economics.*—General theory of the inception and completion of railroad projects; probable volume of traffic and its probable growth; effect of details of alignment on operating expenses and revenue. Prerequisite, Civil Engineering 15. Two hours. First term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 18. *Railroad Design.*—Elements of the design of yards, terminals and sidings; slip-switches, crossings and track details. Prerequisites, Civil Engineering 15, Civil Engineering 16. Two hours. First term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 19. *Geodesy: Theory.*—Study of the instruments and field methods used in geodetic surveying and theory of adjustment of observations. Prerequisites, Civil Engineering 10, Civil Engineering 11. Two hours. Second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 20. *Geodesy: Practice.*—Practice in the use of instruments of precision for the measurement of base-lines, angles, and differences of elevation. Prerequisites, Civil Engineering 10, Civil Engineering 11. Concurrent with Civil Engineering 19. Three hours. Second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 25. *Hydromechanics.*—Energy of fluids. Flow by orifices, tubes and weirs. Flow in pipes, conduits, canals and natural streams. Current meters. Hydraulic motors. Measurement of water-power. Prerequisite, Mathematics 40. Four hours. First term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 26. *Hydraulic Testing.*—Tests for determining the discharge of water through orifices and pipes and over weirs; and of the efficiency of different types of hydraulic motors. Concurrent with or following Civil Engineering 25. Three hours. For half of the class each term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 27. *Water-Supplies.*—Consumption by municipalities. Yields from various sources. Examination of water-supplies. Impounding reservoirs. Purification. Distribution. Prerequisites, Civil Engineering 25, Mathematics 40. Two hours. Second term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 28. *Sanitary Engineering.*—Sewers and drains. Construction and ventilation. Disposal of sewage. Prescribed also for students in the course in Public Hygiene. Prerequisite (for Civil Engineering students), Civil Engineering 25. Two hours. Second term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 29. *Hydraulic Works Design.*—The designing of water and sewerage works. Prerequisites, Civil Engineering 25, Civil Engineering 27, Civil Engineering 28. Five hours. First term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 30. *Roads and Pavements.*—Construction, maintenance and cost. Consideration of the relative merits of the various types. Two hours. First term. PROFESSOR EASBY, ASSISTANT PROFESSOR PARDOE.

CIVIL ENGINEERING 35. *Materials of Construction.*—Physical characteristics of the materials of construction, and the conditions by which these are influenced. Prerequisite, Civil Engineering 40. Two hours. Second term. PROFESSOR BERRY.

CIVIL ENGINEERING 36. *Materials Testing.*—Tests for determining the physical properties of steel, wrought and cast iron, timber, brick, etc. Concurrent with or following Civil Engineering 35, Civil Engineering 40. For half of the class each term. PROFESSOR BERRY.

CIVIL ENGINEERING 37. *Cement Testing.*—Tests for determining the physical properties of cement, sand, mortar and plain and reinforced concrete. Three hours. First term. PROFESSOR BERRY.

CIVIL ENGINEERING 40. *Mechanics of Materials.*—The resistance and elasticity of materials. Theory of flexure applied to beams and columns. Torsion. Effect of impact. Resilience, fatigue, etc. Prerequisite, Mathematics 40. Five hours. First term. MR. WARWICK.

Civil Engineering 41. *Graphic Statics.*—Graphic methods applied to the determination of stresses, bending moments, shears, etc. Concurrent with Civil Engineering 42. One hour. Second term. Mr. Warwick.

Civil Engineering 42. *Framed Structures.*—Determination of stresses by analytic methods. Analysis of different types of bridge and roof trusses, viaducts, turn-tables, etc. Prerequisite, Civil Engineering 40. Five hours. Second term. Mr. Warwick.

Civil Engineering 43. *Framed Structures.*—Stresses in cantilever, arch and swing bridges. Prerequisite, Civil Engineering 42. Four hours. First term. Mr. Warwick.

Civil Engineering 44. *Bridge Design.*—Complete design of a plate-girder bridge. Computations and detail drawings. Concurrent with Civil Engineering 42. Three hours. Second term. Mr. Warwick.

Civil Engineering 45. *Bridge Design.*—Complete design of a railroad bridge. Pratt truss. Computations and detail drawings. Prerequisite, Civil Engineering 44. Three hours, first term. Five hours, second term. Mr. Warwick.

Civil Engineering 46. *Masonry.*—Foundations, dams, retaining walls, piers, abutments, culverts, arches, and concrete constructions. Elements of stereotomy. Three hours. First term. Assistant Professor Slagle.

Civil Engineering 47. *Masonry Design.*—General design of a variety of masonry structures. Prerequisite, Civil Engineering 46. Three hours. Second term. Assistant Professor Slagle.

Civil Engineering 48. *Reinforced Concrete.*—The theory and practice of reinforced concrete applied to the design of beams, columns, arches and other forms of construction. Four hours. First term. Professor Berry.

Civil Engineering 50. *Engineering Computations.* — Short methods and checks in arithmetical computations. Use of slide rule. One hour. First term. Professor Ingram, Assistant Professor Grandlienard.

CIVIL ENGINEERING 52. *Summer Memoir.*—A memoir of not less than sixteen hundred words, prepared during the summer vacation following the Junior year, descriptive of some engineering work or manufacturing plant, based on direct personal inquiries and observations.

CIVIL ENGINEERING 53. *Thesis.*—Thesis on a professional subject. Six hours. Second term. PROFESSORS EASBY, INGRAM and BERRY, ASSISTANT PROFESSORS SLAGLE, GRANDLIENARD and PARDOE, MR. WARWICK.

CIVIL ENGINEERING 61. *Surveying: Theory.*—Short course for Mechanical and Electrical Engineering students only. Three hours. Half of second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 62. *Surveying: Practice.*—Short course for Mechanical and Electrical Engineering students only. Prerequisite, Civil Engineering 61. Three hours. Half of second term. PROFESSOR INGRAM, ASSISTANT PROFESSOR GRANDLIENARD.

CIVIL ENGINEERING 63. *Municipal Water Supplies.*—The quantity of water required; yield of sources; water purification; general features of water works design and construction. Prescribed for students in the course in Public Hygiene. Two hours. Second term. PROFESSOR EASBY.

CIVIL ENGINEERING 64. *Disposal of Municipal Refuse and Street Cleaning.*—Classification and description of wastes. Methods of collecting, incinerating and reducing wastes. Methods of street cleaning. Prescribed for students in the course in Public Hygiene. One hour. Second term. PROFESSOR EASBY.

CIVIL ENGINEERING 65. *Materials Testing.*—Abridged course for students in Architecture taking the fourth-year option in construction. Tests for determining the properties of steel, wrought and cast iron and timber. Concurrent with Civil Engineering 35. Three hours. First eight weeks of second term. PROFESSOR BERRY.

## ECONOMICS.

ECONOMICS OF BUSINESS 1. The principles of Economics adapted especially to the needs of engineering students. Given to Seniors in Electrical and Mechanical Engineering.

## ELECTRICAL ENGINEERING.

ELECTRICAL ENGINEERING 1. *Principles of Electrical Engineering.*—Principles of electricity and magnetism; electric and magnetic circuits; direct current generators and motors; storage batteries. Five hours. First term. Junior year. Requisites, Physics 18, 20, and concurrent with Electrical Engineering 3. PROFESSOR PENDER, MR. DUVALL.

ELECTRICAL ENGINEERING 2. *Electrical Measurements.*—The principles, construction, and use of instruments for the measurement of resistance, current, electromotive force, capacity, inductance, power, and energy; methods of measuring these quantities; methods of calibrating commercial instruments; iron testing. Two hours. Both terms. Junior year. Requisites, concurrent with Electrical Engineering 1 and 4. MR. BROWN.

ELECTRICAL ENGINEERING 3. *Electric Laboratory.*—A laboratory course covering the same topics as Electrical Engineering 1, 2 and 4. Four hours, first term; seven hours, second term. Junior year. Requisites, concurrent with Electrical Engineering 1, 2 and 4. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 4. *Alternating Currents.*—Definitions of terms; instantaneous values and effective values; phase relations; power factor; impedance and reactance; calculations of circuits; analysis of complex waves; polyphase circuits; building up and decay of current and voltage in circuits. Four hours. Second term. Junior year. Requisites, Electrical Engineering 1, Mathematics 43, and concurrent with Electrical Engineering 3. PROFESSOR PENDER, MR. BROWN.

ELECTRICAL ENGINEERING 5. *Electrical Laboratory.*—A laboratory course covering essentially the same topics as Electrical Engineering 2 but adapted to non-electrical engineering students. This course is given in conjunction with Electrical Engineering 32, first and second terms. Junior year. Requisite, concurrent with Electrical Engineering 31 and 33. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 11. *Illumination.*—Principles of illuminating engineering; photometry; practical problems in the lighting of factories and offices. Two hours. First term. Senior year. Requisites, Electrical Engineering 1 and 4. PROFESSOR CLEWELL.

Electrical Engineering 12. *Seminar.*—During the first term, each Senior student is assigned one or more topics of timely interest. Upon each of these he prepares a paper of some 2500 words. He then presents extemporaneously a synopsis of this paper before the Senior class and Instructing Staff. During the second term, each Senior student reviews in an extempore talk of some twenty minutes, at least one important paper which has recently appeared in some one of the technical journals. One hour. Both terms. Senior year. Requisites, Electrical Engineering 1 and 4. Professor Pender and Staff.

Electrical Engineering 13. *Electric Power Plants.*—Location of central station and substations; choice and arrangement of prime movers and auxiliary apparatus for steam-electric and hydroelectric plants; plans and diagrams for typical layouts; preliminary cost estimates; operating and fixed charges. Three hours. Second term. Senior year. Requisite, concurrent with Electrical Engineering 17. Mr. DuVall.

Electrical Engineering 14. *Electric Railways.*—Forces acting on a train; speed-time curves; energy requirements; motor capacity; train diagrams; distribution lines; power-house requirements; systems of control; alternating versus direct current; electricity versus steam; preliminary cost estimates. Three hours. Second term. Senior year. Requisite, concurrent with Electrical Engineering 17. Professor Pender, Mr. DuVall.

Electrical Engineering 15. *Motor Applications.*—Analysis of the speed-torque characteristics of mechanical machinery to which electrical drive is applicable; selection of type of motor applicable thereto; types of motor control; costs. Three hours. Second term. Senior year. Requisite, concurrent with Electrical Engineering 17. Professor Clewell, Mr. Brown.

Electrical Engineering 16. *Distribution and Transmission.*—Systems in use; general requirements; calculation of direct and alternating current lines; mechanical design; poles, towers, insulators, erection; control and protection; preliminary cost estimates. Two hours. First term. Senior year. Requisites, Electrical Engineering 1 and 4. Professor Pender.

Electrical Engineering 17. *Alternating Current Machinery.*—Principles involved in the design, construction, operation, and testing of alternators, synchronous motors, transformers, induction motors, and single-phase commutator motors. Four hours. Both terms. Senior year. Requisites, Electrical Engineering 1, 2, 3 and 4, and concurrent with Electrical Engineering 18. PROFESSOR PENDER, PROFESSOR STRAW.

ELECTRICAL ENGINEERING 18. *Electric Machinery Laboratory.*—Commercial methods of testing electric machinery and apparatus; special tests illustrative of the principles covered in Electrical Engineering 17; photometric and illumination tests. Seven hours, first term; four hours, second term. Senior year. Requisite, concurrent with Electrical Engineering 11 and 17. PROFESSOR STRAW and Instructors.

ELECTRICAL ENGINEERING 19. *Electrical Thesis.*—Solution of special problems in electrical engineering. Nine hours. Second term. Senior year. Requisite, in last year only. PROFESSOR PENDER and Staff.

ELECTRICAL ENGINEERING 20. *Telegraphy and Telephony.*—General layout of telephone systems; transmitters and receivers; theory of the transmission of currents over long lines, with applications to loading of telephone lines and to submarine telegraphy; telegraph systems; central office equipment; combined telephone and telegraph systems; inductive disturbances; estimates. One or two visits are made to local exchanges. Three hours. Second term. Requisites, Electrical Engineering 1, 4 and 16. PROFESSOR PENDER.

ELECTRICAL ENGINEERING 31. *Elements of Electrical Engineering.*—For students in Mechanical and Chemical Engineering. Fundamental principles of direct current and alternating current circuits and instruments. A brief course covering the same topics as Electrical Engineering 1, 2 and 4. Four hours. First term. Junior year. Requisites, Physics 18, 20, and concurrent with Electrical Engineering 32. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 32. *Electric Laboratory.*—For students in Mechanical and Chemical Engineering. A laboratory course covering the same topics as Electrical Engineering 31 and 33 (first part), but somewhat shorter. Three hours. Both terms. Junior year. Requisite, concurrent with Electrical Engineering 31 and 33. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 33. *Electric Machinery.*—For students in Mechanical and Chemical Engineering. The operating characteristics of direct and alternating current machinery. A brief course covering the same topics as Electrical Engineering 17. Three hours. Second term. Junior year. Requisite, Electrical Engineering 31. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 41. *Industrial Applications of Electricity.*—For students in Mechanical and Chemical Engineering. Covers approximately the same ground as Electrical Engineering 11 and 15. Three hours. First term. Senior year. Requisites, Electrical Engineering 31, 32 and 33, and concurrent with Electrical Engineering 42. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 42. *Electric Machinery Laboratory.*—For students in Mechanical and Chemical Engineering. A laboratory course covering the same topics as Electrical Engineering 33 (second part) and 41. Three hours. First term. Senior year. Requisite, concurrent with Electrical Engineering 41. PROFESSOR CLEWELL and Instructors.

ELECTRICAL ENGINEERING 51. *Applied Electricity.*—For students in Civil Engineering. A short course dealing with the operating characteristics of generators and motors, with special reference to the application of the latter in civil engineering work. Three hours. First term. Senior year. Requisites, Physics 18, 20. MR. DUVALL.

## ENGLISH.

### COMPOSITION.

ENGLISH 1. *Composition.*—Weekly themes on assigned subjects. Prerequisites, English **A** and **B** (admission), and either English **C** or English 9. Two hours. Both terms. Two units. ASSISTANT PROFESSORS O'BOLGER, SHELLY, MCCLELLAND and OWEN, MR. HARBESON, MR. MENDENHALL, MR. DOLMAN, MR. LAURIE, DR. BAUGH, DR. KITCHEN, MR. BARROLL, MR. BLACK, MR. MUSSER, MR. STINE, MR. SHAABER.

ENGLISH 2. The general method of English 1 is followed in this course likewise, with special attention to the requirements of engineering students. Prerequisites, English **A** and **B** (admission), and either English **C** or English 9. Two hours. Both terms. Two units. Instructors as for English 1.

ENGLISH 3. *Composition.*—Weekly themes; descriptive, narrative, expository. Prerequisite, English 1. One hour. Both terms. One unit. ASSISTANT PROFESSORS O'BOLGER, SHELLY, OWEN and MCCLELLAND, MR. HARBESON, MR. MENDENHALL, MR. DOLMAN, MR. LAURIE, DR. BAUGH, MR. KITCHEN, MR. BARROLL, MR. MUSSER, MR. STINE, MR. SHAABER.

ENGLISH 4. *Composition.* Weekly themes as in Course 3, except that the course extends over one term only. Prerequisite, English 2. One hour. One term. One-half unit. Instructors as for English 3.

ENGLISH 9. *Composition.*—A first year course in composition designed to help students who have not obtained credit for the qualifying examination in English **C**. Prerequisites, English **A** and **B**. (Admission.) Two hours. Both terms. Instructors as for English 1.

### ENGLISH LANGUAGE.

ENGLISH 30. *English Language.*—An historical treatment of the English language. Prerequisites, English **A** and **B** (admission). Two hours. Second term. One unit. PROFESSOR CHILD, PROFESSOR QUINN, ASSISTANT PROFESSORS O'BOLGER and SHELLY, MR. MENDENHALL, DR. BAUGH, MR. BLACK.

### LITERATURE.

ENGLISH 40. *History of English Literature.*—From Anglo-Saxon times to the present day. Prerequisites, English **A** and **B** (admission). Two hours. Either term. One unit. PROFESSOR PENNIMAN, PROFESSOR CHILD, PROFESSOR WEYGANDT, ASSISTANT PROFESSOR SHELLY, ASSISTANT PROFESSOR MCCLELLAND, ASSISTANT PROFESSOR OWEN, MR. HARBESON, MR. MENDENHALL, MR. DOLMAN, MR. LAURIE, DR. BAUGH, DR. KITCHEN, MR. BARROLL.

ENGLISH 41. *History of Modern English Literature.*—From Shakespeare to the present day. Prerequisites, English **A** and **B** (admission). Instructors as for English 40.

ENGLISH 41 F. *History of English Literature.*—For foreign students. A course specially designed to aid foreign students in making an acquaintance with English literature. Two hours. First term. One unit. ASSISTANT PROFESSOR O'BOLGER.

ENGLISH 42. *Nineteenth Century Novelists.*—Prerequisites, English 1, 30, 40. Two hours. First term. One unit. PROFESSOR PENNIMAN, PROFESSOR QUINN, PROFESSOR WEYGANDT, ASSISTANT PROFESSOR MCCLELLAND, MR. HARBESON, MR. MENDENHALL, DR. KITCHEN.

ENGLISH 42 F. *Nineteenth Century Novelists.*—For foreign students. A course intended to acquaint foreign students with recent and contemporary English writers. Two hours. Second term. One unit. ASSISTANT PROFESSOR O'BOLGER.

ENGLISH 43. *English Essayists.*—Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. PROFESSOR SCHELLING, PROFESSOR PENNIMAN, ASSISTANT PROFESSOR SHELLY.

ENGLISH 50. *Anglo-Saxon Literature.* — Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. PROFESSOR CHILD.

ENGLISH 60. *The Age of Elizabeth.*—Prerequisites, English 1, 30, 40. Two hours. First term. One unit. PROFESSOR SCHELLING.

ENGLISH 62. *Elizabethan Dramatists.*—Prerequisites, English 1, 30, 40. Two hours. First term. One unit. PROFESSOR SCHELLING.

ENGLISH 63. *Seventeenth Century Drama.*—Prerequisite, English 62. Two hours. Second term. One unit. PROFESSOR SCHELLING.

ENGLISH 64. *The English Lyric.*—Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. PROFESSOR SCHELLING.

ENGLISH 71. *The English Bible.*—Prerequisites, English 1, 30, 40. Two hours. First term. One unit. PROFESSOR PENNIMAN.

ENGLISH 90. *Nineteenth Century Poets.*—Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. PROFESSOR SCHELLING, PROFESSOR PENNIMAN, ASSISTANT PROFESSOR MCCLELLAND.

ENGLISH 91. *Nineteenth Century Drama.*—Prerequisites, English 1, 30, 40. Two hours. First term. One unit. PROFESSOR WEYGANDT.

ENGLISH 93. *English Literature in Ireland from 1850.*—Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. PROFESSOR WEYGANDT.

English 98. *Poe and Emerson.*—An intensive reading course. Prerequisites, English 1, 30, 40. Two hours. Second term. One unit. Professor Quinn.

English 99. *The Drama in America.*—Lectures and readings. Prerequisites, English 1, 30, 40. Two hours. First term. One unit. Professor Quinn.

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## FRENCH.

French 1. *Elementary French.*—Elementary Grammar and Reading. François, *Beginner's French;* Super, *French Reader;* Labiche and Martin, *Le voyage de M. Perrichon;* Mérimée, *Colomba;* Labiche, *La Grammaire.* Four hours. Both terms. Four units. Assistant Professor Hurlburt, Mr. Cole, Mr. Meredith.

French 2. *Intermediate French.*—Daudet, *Tartarin de Tarascon;* Mérimée, *Contes;* Maupassant, *Contes;* A. de Musset, *Comédies;* Augier, *Le gendre de M. Poirier;* Rostand, *Les Romanesques;* P. Loti, *Ramuntcho.* Prerequisite, French A (admission). Two hours. Both terms. Two units. Professor Crawford, Assistant Professor Schappelle, Mr. Cole, Mr. Meredith.

French 3. *Intermediate French Grammar.*—Written and oral exercises. Prerequisite, French A (admission). One hour. Both terms. One unit. Professor Crawford, Assistant Professor Schappelle, Mr. Cole, Mr. Meredith.

French 4. *Advanced French for Architects.*—Palustre, *L'Architecture de la Renaissance, etc.* Prerequisite, French 2, or French B (admission). Two hours. Two terms. Two units. Assistant Professor Schappelle.

French 5. *Advanced French Grammar.*—Prose Composition. Conversation. Prerequisite, French 3, or admission B. One hour. Both terms. One unit. Assistant Professor Schappelle.

French 6. *Scientific French Reading.*—Dike, *Scientific French Reader;* French technical journals. For Sophomore engineers. Prerequisite, French 2. Two hours. Both terms. Two units. Assistant Professor Vaughan.

French 7. *Scientific French Grammar.*—Prose Composition. Conversation. For Sophomore engineers. Prerequisite, French 3. One hour. Both terms. One unit. Assistant Professor Vaughan.

FRENCH 8. *Scientific French.*—Dike, *Scientific French Reader;* French technical journals. Prerequisites, French 2 and 3. Two hours. Both terms. Two units. ASSISTANT PROFESSOR SCHAPPELLE.

FRENCH 9. *Advanced Scientific French.—La Revue Scientifique.* Prerequisite, French 4 or 6 or 8. Two hours. Both terms. Two units. ASSISTANT PROFESSOR VAUGHAN.

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## GEOLOGY, MINERALOGY.

GEOLOGY 3. *General Geology.*—The fundamentals of the science of the earth. Igneous action, earthquakes and other dynamic agents and results. Lithology and structures, oceanic and physiographic geology. Outlines of Historical Geology, including the evidences of early human history. Three hours per week. Two terms. Three units. ASSISTANT PROFESSOR EHRENFELD.

GEOLOGY 9. *Inorganic Geology.*—Prerequistes, Chemistry 1, Mineralogy 6. For Civil Engineering students only. Two hours. Second term. One unit. ASSISTANT PROFESSOR EHRENFELD.

MINERALOGY 1. *Mineralogy.*—General introduction to the science of Mineralogy and Crystallography An acquaintance with crystal forms and the chief groups of minerals is acquired by recitation and practice. Lectures are given on theoretical and practical aspects of minerals, together with a brief outline of the history of the science. Three hours. Both terms. Three units.

MINERALOGY 3. *Practical Determinative Mineralogy.*—Laboratory work in the practical study and determination of minerals by physical as well as chemical properties. Chemistry 1 and 3 should precede this course. Two hours. Both terms. One unit.

MINERALOGY 6. *Mineralogy.*—Short course in Mineralogy. Prerequisites, Chemistry 1 and 3. Open to Civil Engineering students only. Two hours. First term. One unit.

MINERALOGY 7. *Mineralogy, General Mineralogy and Crystallography.*—Course for Chemical Engineering students only. One term. Two hours. One unit.

## GERMAN.

German 1. *Elementary German.*—Grammar and reading. Four hours. Both terms. Four units. Dr. Fogel.

German 2. *Reading of Literary Prose and Eighteenth Century Drama.*—Prerequisite, German A (admission) or an approximate equivalent. Two hours. Both terms. Two units. Assistant Professor Johnson, Dr. Fogel, Dr. Vollmer, Dr. Scholz.

German 3. *Grammar and Composition.*—Written and oral exercises. Prerequisite, German A (admission) or an approximate equivalent. One hour. Both terms. One unit. Professor Wesselhoeft, Assistant Professor Johnson, Dr. Fogel, Dr. Vollmer, Dr. Scholz.

German 4. *Scientific Prose for Freshman Engineers.*—Prerequisite German A (admission), or an approximate equivalent. One hour. Both terms. One unit. Dr. Vollmer.

German 5. *Lectures on Schiller's Life and Works, and the Literary Movements of His Time.*—Reading of selected texts. Prerequisites, German 2 and 3. Two hours. First term. One unit. Professor Wesselhoeft.

German 6. *Reading of Selected Historical Prose.*—Prerequisites, German 2 and 3. Two hours. Second term. One unit. Professor Wesselhoeft.

German 7. *German Composition and Conversation.*—Prerequisite, German 3. One hour. Both terms. One unit. Professor Wesselhoeft.

German 8. *Intermediate Scientific German.*—Prerequisites, German 2 and 4. Two hours. Both terms. Two units. Assistant Professor Johnson.

German 9. *Literary German for Engineers.*—Prerequisites, German 2 and 4. One hour. Both terms. One unit. Assistant Professor Johnson.

German 10. *Scientific Reading for Chemists.*—Prerequisites, German 2 and 3. Two hours. Both terms. Two units. Professor Wesselhoeft.

GERMAN 11. *Advanced Scientific Reading.*—Prerequisite, German 10. Two hours. Both terms. Two units. PROFESSOR WESSELHOEFT.

## HISTORY.

HISTORY 3. *Medieval History.*—Two hours lecture and one hour quiz per week. Both terms. Three units. PROFESSOR HOWLAND.

## HYGIENE.

HYGIENE 1. This course consists of ten lectures introductory to Architecture 34 and 35. First term. PROFESSOR EGBERT.

## ITALIAN.

ITALIAN 1. *Elementary Italian.*—Grandgent's Italian Grammar. Wilkins and Altrocchi, Italian Short Stories. Goggio, Due Commedie Moderne. Three hours. Both terms. Three units. ASSISTANT PROFESSOR SCHAPPELLE.

ITALIAN 2. *Intermediate Italian.*—Manzoni, I Promessi Sposi; Dante, Selections from the Inferno (Cotterill). Prerequisite, Italian 1. Three hours. Both terms. Three units. PROFESSOR RENNERT.

ITALIAN 3. *Advanced Italian.*—Three hours. Both terms. Three units.

## MATHEMATICS.

MATHEMATICS 6. *Analytic Geometry.*—Prerequisites, Mathematics A, C and F. Three hours. First or second term. One and a half units.

MATHEMATICS 31. *Algebra.*—For Freshmen in the course in Chemistry. Prerequisites, Mathematics A, C and F. Four hours. First term. Two units.

MATHEMATICS 32. *Fundamental Principles of Analytic Geometry and Calculus with Applications.*—For Freshmen in the course in Chemistry. Prerequisites, Mathematics D and 31. Four hours. Second term. Two units.

MATHEMATICS 33. *Algebra and Plane Trigonometry.*—For Freshmen in the course in Architecture. Prerequisites, Mathematics A and C. Four hours. First term. Two units.

MATHEMATICS 34. *Algebra (continued) and Analytic Geometry.*—For Freshmen in the course in Architecture. Prerequisites, Mathematics D and 33. Four hours. Second term. Two units.

MATHEMATICS 35. *Advanced Trigonometry and Algebra.*—For Freshmen in the courses of Engineering who have passed the classifying examination Mathematics M.* Prerequisites, Mathematics A, C, F and M. Five hours. First term. Two and one-half units. Those who fail to pass Mathematics M will take Mathematics 45 in the first term, and Mathematics 46 second term.

MATHEMATICS 36. *Algebra and Analytic Geometry.*—Prerequisites, Mathematics D and 35. Five hours. Second term. Two and one-half units. For Freshmen in the Engineering courses.

MATHEMATICS 37. *Differential Calculus with Applications.*—For Sophomores in the course in Architecture. Prerequisites, Mathematics 33 and 34. Two hours recitation. One hour practice. First term. One unit.

MATHEMATICS 38. *Integral Calculus with Applications.*—For Sophomores in the course in Architecture. Prerequisite, Mathematics 37. Two hours recitation. One hour practice. Second term. One unit.

MATHEMATICS 39. *Calculus, Part I.*—For Sophomores in the Engineering courses. Prerequisites, Mathematics 35 and 36, or 6, 45 and 46. Four hours. First term. Two units.

MATHEMATICS 40. *Calculus continued.*—For Sophomores in the Engineering courses. Prerequisite, Mathematics 39. Four hours. Second term. Two units.

MATHEMATICS 41. *Lectures on Various Mathematical Topics.*—A series of lectures on mathematical subjects directly applicable to engineering problems. Open to Juniors and Seniors of the Towne Scientific School, attendance voluntary. Prerequisite, Mathematics 40 or 38 or 32. One hour. Both terms.

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*This examination covers elementary algebra and plane trigonometry, and will be held in 1919, on Tuesday, September 23, at 11 A. M., in College Hall. (See page 38.)

Mathematics 43. *Differential Equations.*—For Juniors in the course in Electrical Engineering. Prerequisite, Mathematics 40. Three hours. First term. One and a half units.

Mathematics 45. *Intermediate Algebra and Elementary Trigonometry.*—For Freshmen in the engineering courses who fail to pass the classifying examination (Mathematics M). Students who take this course in the first term will have Mathematics 46 in the second term. Five hours. First term. Two and one-half units.

Mathematics 46. *Trigonometry and Algebra.* — Prerequisites, Mathematics D and 45. Students who complete courses 45 and 46 will have covered the trigonometry and algebra of courses 35 and 36. Such students must obtain credit in Mathematics 6 or its equivalent before entering course 39. Five hours. Second term. Two and one-half units.

## MECHANICAL ENGINEERING.

Mechanical Engineering 1. *Mechanical Drawing.*—Use of instruments. Making detail mechanical drawings from working sketches. Freehand lettering. Three hours. Both terms. Freshman year. Professor Fry.

Mechanical Engineering 2. *Shop Work.*—Elements of machines, wood working and forging. Collateral reading and monthly examinations. Six hours first term; three hours second term. Freshman year. Professor Morris.

Mechanical Engineering 3. *Shop Work.*—Short course for Chemical Engineering students only. Six hours. First term. Professor Morris.

Mechanical Engineering 4. *Descriptive Geometry.*—Problems involving the essential relations of points, lines and planes; ruled surfaces and double-curved surfaces. Three hours. Both terms. Freshman year. Professor Crofoot.

Mechanical Engineering 11. *Mechanical Drawing and Sketching.*—Continuation of Mechanical Engineering 1. Assembly and detail drawings made from sketches. Tracing. Checking. Blue printing. Machine sketching. Three hours. Both terms. Sophomore year. Requisites, Mechanical Engineering 1, 4. PROFESSOR FRY.

MECHANICAL ENGINEERING 12. *Advanced Shop Work.*—Pattern making. Use of machine tools. Principles of foundry practice. Laying out work. Six hours. Both terms. Sophomore year. Requisites, Mechanical Engineering 1, 2, 4. PROFESSOR MORRIS.

MECHANICAL ENGINEERING 13. *Advanced Shop Work.*—Short course for Chemical Engineering students only. Six hours. Second term. Freshman year. Requisite, Mechanical Engineering 3. PROFESSOR MORRIS.

MECHANICAL ENGINEERING 14. *Elements of Engineering.*—Nomenclature of steam machinery. General principles of the construction of machines. Power measurement. Two hours. First term. Sophomore year. Requisites, Mechanical Engineering 1, Mechanical Engineering 2 or 3. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 15. *Kinematics.*—Laws of motion. Combination of pure mechanism. Pulleys and belts. Trains of gearing and forms of teeth of wheels. Link work, epicyclic trains, etc. Three hours. Second term. Sophomore year. Requisite, Mechanical Engineering 14. PROFESSOR CROFOOT.

MECHANICAL ENGINEERING 21. *Kinematic Design Drawings.*—Designing and laying out mechanical movements. Empirical designing of the parts of a mechanism. Three hours. First term. Junior year. Requisites, Mechanical Engineering 11, 12, 14, 15. PROFESSOR FRY.

MECHANICAL ENGINEERING 22. *Mechanics of Materials.*—Application of the principles of statics to rigid bodies. Elasticity and strength of materials. Forms of uniform strength. Design of beams, columns and shafts. Combined and repeated stresses. Four hours. First term. Junior year. Requisites, Mathematics 40, Physics 16, 17, 20. PROFESSOR CROFOOT.

MECHANICAL ENGINEERING 23. *Hydraulics.*—Transmission of pressures. Determining centers and amount of pressure. Depth of flotation and stability. Flow through orifices, over weirs, through tubes, pipes and conduits. Water meters and the measurement of water power. Two hours. First term. Junior year. Requisites, Mathematics 40, Physics 16, 17, 20. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 24. *Seminar.*—The preparation of seminar papers and data sheets, a discussion of engineering articles in the current magazines, bulletins and proceedings, and a discussion of general engineering subjects. One hour. Both terms. Junior year. Requisite, in Junior year only. PROFESSOR FERNALD.

MECHANICAL ENGINEERING 25. *Machine Design and Drawing.*—Principles of machine design. Analytical design of machine elements. Design of power punch. Elements of structural design of a truss, girder, column and framing are given in the second term. Three hours. Both terms. Junior year. Requisites, Mechanical Engineering 11, 12, 14, 15, and concurrent with Mechanical Engineering 21, 22. PROFESSOR FRY.

MECHANICAL ENGINEERING 26. *Mechanical Laboratory.*—Testing mechanical apparatus. Adjusting scales, indicators, counters, gauges, etc. Determining the efficiency of various machines and the values of the materials of construction. Three hours. Both terms. Junior year. Requisites, Mechanical Engineering 11, 12 or 13, 15, Mathematics 40, and concurrent with Mechanical Engineering 22, 23. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 27. *Graphics.*—Principles of graphic statics and their applications to cranes, bridges, roof trusses and other framed structures. The graphics of machinery with and without friction, graphic combination of stresses in shafts, etc. Five hours. Second term. Junior year. Requisites, Mechanical Engineering 11, 15, 22, Physics 16, 17, 20. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 28. *Thermodynamics.*—Mechanical theory of heat. Work done and heat expended in expansion. Cycles of perfect gases and vapors. Expansion of steam, ammonia and carbonic acid, work done and heat required. Mixtures of vapors. Three hours. Second term. Junior year. Requisites, Mechanical Engineering 14, Mathematics 40, Physics 16, 17, 20. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 41. *Machine Design.*—For students in Mechanical Engineering. Applications of the principles of machine design to special machinery. Four hours. First term. Senior year. Requisites, Mechanical Engineering 12 or 13, 15, 21, 22, 25, 27. For students in Chemical Engineering. Design of layout and equipment of a chemical plant. Four hours. Second term. Senior year. Requisites, Mechanical Engineering, 11, 13, 14, 22, 71. PROFESSOR FRY.

MECHANICAL ENGINEERING 42. *Hydrodynamics.*—Theory of turbines, water wheels, and centrifugal pumping machinery. Two hours. First term. Senior year. Requisite, Mechanical Engineering 23. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 43. *Heat Power Engineering.*—Heat engines, various efficiencies. Commercial results obtained and possibilities of development of steam, air, gas and oil engines. Refrigerating machines using air, ammonia, carbonic acid, etc. Flow of steam injectors and condensers. Three hours. First term. Senior year. Requisite, Mechanical Engineering 28. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 44. *Seminar.*—A continuation of Mechanical Engineering 24. One hour. Both terms. Senior year. Requisite, in last year only. PROFESSOR FERNALD.

MECHANICAL ENGINEERING 45. *Advanced Mechanical Laboratory.* —Testing steam, gas and air engines, and boilers, determining duty of pumps, injectors, air compressors, measurement of flow of steam, calorimetric work. Seven hours, first term; two hours, second term. Senior year. Requisites, Mechanical Engineering 22, 23, 26, 27, and concurrent with Mechanical Engineering 43. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 46. *Power Plants.*—A discussion of the choice of types of prime movers for various installations, their relative cost, efficiency and durability. Many problems involved in the economic use of various kinds of fuel are presented Four hours first term for Electrical and Chemical Engineers; four hours second term for Mechanical Engineers. Senior year. Requisite, in last year only. PROFESSOR FERNALD.

MECHANICAL ENGINEERING 47. *Mechanical Thesis.*—Special work in Mechanical Laboratory. Nine hours. Second term. Senior year. Requisite, in last year only. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 48. *Out of Town Inspection Trip.*—An examination of the special features of important engineering developments in various sections of the country. Two weeks. Second term. Senior year. (Probable dates of 1920 trip, March 17 to 31, inclusive.) Requisite, in last year only. PROFESSOR FERNALD.

MECHANICAL ENGINEERING 51. *Steam Engines.*—Systematic calculation of the proper proportions of the parts of a simple steam engine. Three hours. First term. Senior year. Requisites, Mechanical Engineering 22, 28. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 52. *Steam Turbines.*—Theory of the steam turbine; advantages claimed for the different types; reported efficiencies and economies. Three hours. Second term. Senior year. Requisites, Mechanical Engineering 22, 28. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 53. *Steam Machinery Design.*—Determining the proper proportions of the parts of steam engines, boilers and turbines, calculating where a question of strength enters, and following commercial types for proportions that are determined solely from experience. Four hours. Second term. Senior year. Requisites, Mechanical Engineering 51, and concurrent with Mechanical Engineering 52. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 54. *Heating and Ventilation.*—A discussion of the quantities of air required for proper ventilation; a study and layout of different systems of heating and ventilating, including heating from central stations. Three hours. First term. Senior year. Requisite, Mechanical Engineering 28. PROFESSOR FERNALD.

MECHANICAL ENGINEERING 55. *Internal Combustion Engines.*—Theory and principles of operation. Construction features of various types, fuel mixtures, carburetion, systems of speed control, ignition, lubrication and cooling. Three hours. First term. Senior year. Requisite, Mechanical Engineering 28. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 56. *Manufacture and Distribution of Gas.*—Principles involved in the manufacture of bases for power, light and heat. Apparatus for production and storage. Distribution systems. Two hours. Second term. Senior year. Requisite, in last year only. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 57. *Gas Engineering Design.*—Determination of the principal dimensions of various types of internal combustion engines. Design of gas producer plants, city gas works, distribution systems and auxiliary apparatus. Four hours. Second term. Senior year. Requisites, Mechanical Engineering 22, 55, and concurrent with Mechanical Engineering 56. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 71. *Graphics.*—Same as Mechanical Engineering 27. For students in Electrical and Chemical Engineering. Three hours. Second term. Junior year. Requisites, Mechanical Engineering 11, 15, 22, Physics 16, 17, 20. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 81. *Hydraulic Engineering.*—Principles of hydraulic turbines; hydraulic power plants; hydrology. For students in Electrical Engineering. Two hours. First term. Senior year. Requisite, Mechanical Engineering 23. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 82. *Heat Power Engineering.*—The fundamental principles of combustion, steam boilers, steam engines, steam turbines, gas engines and refrigeration. For students in Electrical and Chemical Engineering. Two hours. First term. Senior year. Requisite, Mechanical Engineering 28. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 83. *Advanced Mechanical Laboratory.*—Same as Mechanical Engineering 45. For students in Electrical Engineering. Three hours. Both terms. Senior year. Requisites, Mechanical Engineering 22, 23, 26, 71, and concurrent with Mechanical Engineering 82. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 84. *Advanced Mechanical Laboratory.*—Same as Mechanical Engineering 45. For students in Chemical Engineering. Three hours. Second term. Senior year. Requisites, Mechanical Engineering 22, 23, 26, 71, 82. PROFESSOR KAVANAUGH.

MECHANICAL ENGINEERING 91. *Mechanical Drawing.*—For students in Chemistry. Elementary drawing, free-hand lettering and sketching. Two hours. First term. Freshman year. PROFESSOR FRY.

MECHANICAL ENGINEERING 92. *Elements of Engineering.*—Same as Mechanical Engineering 14. For students in Chemistry. Two hours. Second term. Freshman year. PROFESSOR STANFORD.

MECHANICAL ENGINEERING 93. *Steam Engines, Boilers and Power Plants.*—For students in Civil Engineering. Four hours. Second term. Senior year. Requisites, Physics 16, 17. PROFESSOR FERNALD.

## MILITARY TRAINING.

See page 130.

## PHILOSOPHY.

PHILOSOPHY 5. *Philosophy of Nature.*—Two hours. Second term. One unit. PROFESSOR SINGER.

## PHYSICAL EDUCATION.

PHYSICAL EDUCATION 1 to 4. Medical and physical examination. swimming tactics, graded gymnastics, free-hand and with apparatus, class athletics and gymnastic games, outdoor track and field athletics, remeasurement and examination. Lectures (second term only) for advanced students on history and physiology of physical training; Anthropometry, gymnastic systems for school, playground, and college; application of exercise for defectives. Prerequisites: for Physical Education 2, Physical Education 1 or its equivalent as provided for in the Gymnasium Manual; for Physical Education 3, Physical Education 2 or its equivalent as provided for in the Gymnasium Manual; for Physical Education 4, Physical Education 3 or its equivalent as provided for in the Gymnasium Manual. Two hours. Both terms. One unit.

## PHYSICS.

NOTE: Courses 16 to 20 are primarily intended for students in Engineering, 26 to 28 for students in Chemistry.

Physics 9. *Electrical Oscillations and Waves.*—Prerequisite, Physics 18. Two hours. Second term. One unit. Professor Goodspeed.

Physics 10. *Dynamics of Aviation.*—Prerequisite, Physics 16. Two hours. First term. One unit.

Physics 16. *Elementary Dynamics.*—This course assumes a knowledge of the usual elementary course in Physics as given in an average high school. It constitutes, when combined with Physics 17 and 18, a complete course in General Physics designed for Engineering students. Prerequisites, Entrance Physics and Mathematics 35 and 36. Six hours lectures and recitations, four hours laboratory. First half of first term. Two units. Omitted in 1919-20.

Physics 17. *Properties of Matter, Heat, Sound and Light.*—The requirements for this course are similar to those for Physics 16. Prerequisite, Physics 16. Six hours lectures and recitations, four hours laboratory. Second half of first term. Two units. Omitted in 1919-20.

Physics 18. *Electricity and Magnetism.*—This completes the course in General Physics given to Engineering students. Prerequisites, Physics 16 and 17; Mathematics 39. Three hours lectures and recitations, two hours laboratory. Second term. Tw units. Assistant Professors Harkins, Barker, Kabakjian, Dr. Book, Dr. R. W. Duncan. (In 1919-20 this course will be given in the first term.)

Physics 20. *Analytic Mechanics.*—A practical course in the elements of Dynamics, consisting largely of problems. It must be preceded or accompanied by a course in Calculus. Prerequisites, Physics 16; Mathematics 39. Three hours lectures and recitations, two hours laboratory. Second term. Two units. Professor Richards, Assistant Professor Barker, Assistant Professor Cope, Assistant Professor Harkins, Dr. R. W. Duncan.

Physics 26. *General Physics.*—A course which in combination with course 27 forms a course in General Physics intended primarily for students in the four-year course in Chemistry. Prerequisites, Entrance Physics and Mathematics 32. Three hours lectures and recitations, three hours laboratory. First term. Two units. Assistant Professor Barker.

Physics 27. *General Physics.*—The continuation of Physics 26. Prerequisite, Physics 26. Three hours lectures and recitations, three hours laboratory. Second term. Two units. Assistant Professor Barker.

Physics 28. *Theoretical Physics.*—A somewhat advanced course in theoretical physics during which a number of special topics are selected for detailed study. Prerequisites, Physics 27; Mathematics 32. Three hours. Both terms. Three units. Professor Goodspeed.

## SPANISH.

Spanish 1. *Elementary Spanish.*—Crawford, *First Book in Spanish;* Hills and Ford, *Spanish Tales for Beginners;* Alarcón, *Novelas Cortas.* Three hours. Both terms. Three units. Professor Crawford, Assistant Professor Vaughan, Mr. Romera-Navarro, Mr. Malakis.

Spanish 2. *Intermediate Spanish.* — Valdés, *José;* Cervantes, *Novelas Ejemplares,* ed. by Rennert; Ibáñez, *La Barraco.* Prerequisites, Spanish 1 or Spanish **A** (admission). Three hours. Both terms. Three units. Professor Rennert, Professor Crawford, Assistant Professor Vaughan, Mr. Romera-Navarro.

Spanish 3. *Spanish Drama.*—The Spanish drama of the seventeenth century. History of Spanish literature. Prerequisite, Spanish 2. One hour. Both terms. One unit. Professor Rennert.

Spanish 4. *Advanced Spanish.*—The books read in this course deal chiefly with South American institutions and industries. Must be preceded by or taken concurrently with Spanish 2. Two hours. Both terms. Two units. Mr. Romera-Navarro.

Spanish 5. *Commercial Correspondence.*—Oral and written exercises. Must be preceded by or taken concurrently with Spanish 2. One hour. Both terms. One unit. Mr. Romera-Navarro.

# DEPARTMENT OF MILITARY SCIENCE AND TACTICS.

MAJOR CHARLES THORPE GRIFFITH, Field Artillery, United States Army, *Professor of Military Science and Tactics.*

Under the provisions of an act of Congress, approved June 3, 1916, the Department of Military Science and Tactics was instituted at the University of Pennsylvania in October, 1916.

The object of the act of Congress referred to above is to standardize courses in military training in Universities, Colleges and High Schools.

A four-year course is prescribed by the War Department in order to qualify, by systematic methods of training, students at civil educational institutions as reserve officers. The system of instruction prescribed presents to these students a standardized measure of that military training which is necessary in order to prepare them to perform intelligently the duties of commissioned officers in the military forces of the United States. Educational institutions throughout the United States have been authorized to maintain one or more units of the Reserve Officers' Training Corps in order that in time of national emergency there may be a sufficient number of educated men trained in military science and tactics, to officer and lead intelligently the units of large armies upon which the safety of the country will depend. The extent to which this object is accomplished will be the measure of the success of the Reserve Officers' Training Corps.

The University of Pennsylvania maintains at present one Infantry unit for which the course of training prescribed by the War Department is as outlined below.

(NOTE: This University will probably establish one additional unit of either the Field Artillery, the Coast Artillery Corps or the Engineer Corps. The different courses of training prescribed for these units are described in General Orders No. 49, War Department, 1916, now under process of revision.)

1. MILITARY ART.

Three hours a week.

(a) *Practical.* Weight, 10.

Physical drill (Manual of Physical Training—Koehler); Infantry drill (U. S. Infantry Drill Regulations), to include the School of the Soldier, Squad and Company, close and extended order. Preliminary instruction, sighting position and aiming drills, gallery practice, nomenclature and care of rifle and equipment.

(b) *Theoretical.* Weight, 4.

Theory of target practice, individual and collective (use of landscape targets made up by U. S. Military Disciplinary Barracks, Fort Leavenworth, Kans.); military organization (Tables of organization); map reading; service of security; personal hygiene.

2. MILITARY ART.

Three hours a week.

(a) *Practical.* Weight, 10.

Physical drill (Manual of Physical Training—Koehler); Infantry drill (U. S. Infantry Drill Regulations), to include School of Battalion, special attention devoted to fire direction and control; ceremonies; manuals (Part V, Infantry Drill Regulations), bayonet combat; intrenchments (584-595, Infantry Drill Regulations); first-aid instruction; range and gallery practice.

(b) *Theoretical.* Weight, 4.

Lectures, general military policy as shown by military history of United States and military obligations of citizenship; service of information; combat (to be illustrated by small tactical exercises); United States Infantry Drill Regulations, to include School of Company; camp sanitation for small commands.

3. MILITARY ART.

Three hours a week.

(a) *Practical.* Weight, 10.

The same as course 2 (a). Combat firing, if practicable, but collective firing should be attempted in indoor ranges by devices now in vogue at United States Disciplinary Barracks.

(b) *Theoretical.* Weight, 4.

United States Infantry Drill Regulations, to include School of Battalion and Combat (350-622); Small-Arms Firing Regulations; lectures as in (b) course 2; map reading; camp sanitation and camping expedients.

4. MILITARY ART.

Three hours a week.

(a) *Practical.* Weight, 10.

The same as course 2 (a); signalling; semaphore and flag; first-aid. Work with sand table by constructing to scale intrenchments, field works, obstacles, bridges, etc. Comparison of ground forms (constructed to scale) with terrain as represented on map; range practice.

(b) *Theoretical.* Weight, 4.

Lectures, military history (recent); service of information and security (illustrated by small tactical problems in patrolling, advance guards, rear guards, flank guards, trench and mine warfare, orders, messages, and camping expedients; marches and camps (Field Service Regulations and Infantry Drill Regulations).

5. MILITARY ART.

Five hours a week.

(a) *Practical.* Weight, 13.

Duties consistent with rank as cadet officers or noncommissioned officers in connection with the practical work and exercises laid down for the unit or units. Military sketching.

(b) *Theoretical.* Weight, 11.

Minor tactics; field orders (studies in minor tactics, United States School of the Line); map maneuvers. Weight, 8.

Company administration, general principles (papers and returns). Weight, 1.

Military history. Weight, 2.

6. MILITARY ART.

Five hours a week.

(a) *Practical.* Weight, 13.

Same as (a) course 5. Military sketching.

(b) *Theoretical.* Weight, 11.

Minor tactics (continued); map maneuvers. Weight, 8.

Elements of international law. Weight, 2.

Property accountability; method of obtaining supplies and equipment (Army Regulations). Weight, 1.

7. MILITARY ART.

Five hours a week.

(a) *Practical.* Weight, 13.

Duties consistent with rank as cadet officers or noncommissioned officers in connection with the practical work and exercises scheduled for the unit or units. Military sketching.

(b) *Theoretical.* Weight, 11.

Tactical problems, small forces, all arms combined; map maneuvers; court-martial proceedings (Manual for Courts-martial).

International relations of America from discovery to present day; gradual growth of principles of international law embodied in American diplomacy, legislation, and treaties.

Lectures: Psychology of war and kindred subjects.

General principles of strategy only, planned to show the intimate relationship between the statesman and the soldier (not to exceed 5 lectures).

8. MILITARY ART.

Five hours a week.

(a) *Practical.* Weight, 13.

Same as course 7 (a).

(b) *Theoretical.* Weight, 11.

Tactical problems (continued); map maneuvers. Rifle in war.

Lectures on military history and policy.

It is presumed that each member of the Reserve Officers' Training Corps during his academic course has taken one course or equivalent credit in either French, or German, or Spanish.

Special courses can no doubt be arranged so that specialists will be developed for duties other than those prescribed for reserve officers of the mobile arms.

It must be clearly kept in mind that these courses are arranged so that the standard required will be that for a platoon leader in an infantry company or of the equivalent unit in the other arms.

Such units cannot be considered apart from the larger ones, which are made up of a combination of smaller ones. Hence intelligent teamwork depends on the leaders of smaller tactical units understanding the working of the larger units of their own arm or in combination with the other arms.

The student upon graduation should know what is required of a platoon from the point of view of the company commander, and understand clearly the interior economy of a company. He must know what is demanded of the soldier as an individual and also in combination as part of a larger organization. The last knowledge should include some idea of the tactical handling of a battalion, of which his company is a smaller unit.

The schedule of training prescribes graded courses covering a period of four years, and instruction will be taken up as follows:

### Basic Course.

Freshman year, courses 1 and 2.
Sophomore year, courses 3 and 4.

### Advanced Course.

Junior year, courses 5 and 6.
Senior year, courses 7 and 8.

## THE LIBRARY.

EDGAR F. SMITH, Provost.
JOSIAH H. PENNIMAN, Ph.D., LL.D., Vice-Provost.

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MORRIS JASTROW, Jr., Ph.D., LL.D., *Librarian.*
KATHARINE S. LEIPER, *Assistant Librarian.*

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The Library is one of the original Departments of the University, possessing among its treasures works presented to the Academy of Philadelphia in 1749; others purchased by a committee of which Benjamin Franklin was chairman in 1750; and still others given by the Rev. William Smith, D.D., first Provost of the College and Academy of Philadelphia; by Louis XVI; and by other early friends and patrons. It now contains 467,226 catalogued volumes, and upwards of 50,000 unbound pamphlets.

In exchange for copies of various University publications, the Library is in annual receipt of a large number of periodicals, and of periodical publications and monographs of learned societies in various parts of the world, as well as the journals, dissertations and scientific contributions of the leading educational institutions in this country and abroad. In addition, the Library receives as a depository the documents and publications of the United States Government, and from foreign governments likewise official publications in considerable numbers. The reports of all the important railroad corporations and banking associations are forwarded to the Library; and arrangements have been made to receive regularly state documents and official reports of the more important municipalities in the United States and Europe. The Library has also been made a depository of the printed catalogue cards of the Congressional Library.

The Library is open on weekdays, from 8.15 A. M. to 10 P. M., and on Sundays from 2 P. M. to 6 P. M. (during the summer vacation, 9 A. M. to 5 P. M., and during the sessions of the Summer School, from 8.15 A. M. to 6 P. M.). The Seminary room in the Library Building, till 11 P. M. Both professors and students (the latter upon presenting their matriculation cards) are permitted to take out books. Graduates of all departments of the University, and other persons recommended by an officer of the University, are granted the same privilege, on the annual payment of three dollars. The Library is open freely to the public for consultation, including the unrestricted use of its collections within the building.

Besides the collections in the main building, there is a special departmental library in the Engineering Building containing books on Civil, Electrical and Mechanical Engineering. Special collections are located in the Departments of Chemistry, Hygiene and Physics. For Architectural students there is a large special collection, comprising the entire Architectural Library of the University in the Architectural Building. All of these departmental libraries are open each day, and, under regulations made by the individual departments, are at the service of students in the Towne Scientific School.

# DEPARTMENT OF PHYSICAL EDUCATION.

## OFFICERS.

EDGAR F. SMITH, Provost.
JOSIAH H. PENNIMAN, Ph.D., LL.D., Vice-Provost.

R. TAIT McKENZIE, B.A., M.D., *Professor of Physical Education, and Director of the Department.*
W. J. CROMIE, *Instructor in Physical Education.*
W. CAMPBELL POSEY, M.D., *Ophthalmologist.*
GEORGE WILSON, M.D., *Medical Examiner and Physician.*
P. SAMUEL STOUT, M.D., *Medical Examiner.*
LEONARDO TERRONE, *Instructor in Fencing.*
GEORGE KISTLER, *Instructor in Swimming.*
GEORGE DECKER, *Instructor in Boxing.*
LAWSON ROBERTSON, *Instructor in Track and Field Athletics.*
JOSEPH WRIGHT, *Instructor in Rowing.*
WILLIAM R. GRIFFITH, *Assistant Instructor in Gymnastics.*
CHARLES KERRIGAN, *Assistant Instructor in Swimming.*

At a meeting of the Board of Trustees, held in May, 1904, it was resolved that the course in Physical Education be made an integral part of the University curriculum. The following regulations are now in force:

The Gymnasium fee is collected from all students of the Towne Scientific School.

The Bursar's receipt entitles the holder to the use of the Gymnasium, shower-baths, swimming-pool and Franklin Field, except when any or all of them are specially reserved, as, for example, in the case of intercollegiate games. Due notice of such reservation will be posted on the bulletin boards at the Gymnasium.

Every locker holder is entitled to a physical examination, including his measurements, a strength test, an examination of his heart, lungs, and general condition, with a special examination of his eyes. On the basis of this examination the kind and amount of exercise best adapted to his needs are outlined, and class instruction is given as arranged in the roster at the beginning of the college year.

In the following cases a certain minimum amount of gymnastic or athletic work is required, for which the student receives credit on the basis of laboratory work counting one unit a year toward his degree. In all other cases the work is optional.

Two periods a week are required in the Towne Scientific School, lasting one hour each, of all students, the work to be graded and made progressive throughout the four years.

Exceptional cases may be excused from this requirement when approved jointly by the Director of the Department of Physical Education and the Dean of the Department; and also the following cases:

First, all full students who have, in the opinion of the Director of the Department of Physical Education, had an equivalent amount of work at this, or another, university or college.

Second, holders of a *college degree.*

Third, those having some physical disability.

Membership, and regular attendance at the practice of any of the athletic squads of the University is taken as an equivalent for gymnasium work only during active training, *the attendance being reported weekly.*

Excuse from the requirement, however, does not in any case waive liability for the payment of the gymnasium fee.

## FACILITIES AND EQUIPMENT.

I. The UNIVERSITY GYMNASIUM, presented to the Trustees by a committee of the Alumni.

The main exercise hall, 144 by 68 feet, is well lighted by a roof of glass, and has a specially designed system of ventilation, thus ensuring a constant supply of fresh air. The iron work overhead gives attachment to the heavy apparatus. The equipment is so arranged as to be quickly put in place or hoisted out of the way, leaving a clear floor space for large classes; while the floor can be divided into three equal spaces by nets, so as to permit the playing of games in which balls are used without interfering with other work. A small spectators' gallery occupies each end.

On the same floor are two rooms, one at each end, with 2,450 expanded metal lockers, and two small dressing-rooms, with shower-baths, for the members of the Faculty and graduates. On the floor beneath are the towel-rooms and shower-baths. The floor below the exercise hall is occupied by the swimming-pool, the rowing-room, and two boxing, fencing and wrestling-rooms.

The pool, 100 by 30 feet, is supplied by a continuous stream of filtered water, which is completely changed once a week. It is commanded on three sides by a spectators' gallery. All the apparatus for teaching swimming is supplied, and the Instructor or his assistant is always in attendance.

The rowing-room, 75 by 30 feet, is used as an accessory gymnasium, with sixteen machines on which the crew do their winter training; and in it are found additional gymnastic apparatus. The two rooms, 30 by 30 feet each, at either end of the rowing-room, are fitted with all the appliances for teaching boxing, fencing and wrestling.

The Director's office and examining rooms are situated in the north wing, while the corresponding rooms of the south wing contain the offices of the instructors and the superintendent of lockers and attendance.

The basement of each wing is taken up by the special Varsity dressing-rooms with 118 lockers, baths, drying-rooms, repair shop and Instructors' rooms.

II. Franklin Field, situated to the east of the gymnasium building and overlooked by it. It is encircled by ¼-mile cinder path and has permanent stands of brick on its north, east and south sides, capable of seating 20,000 spectators. Beneath them are the squash courts and an indoor running track. The stands are connected to the north and south wings of the gymnasium building by brick arches, spanning the entrances to the field.

Instruction is given in both the theory and practice of Physical Education.

Four courses, A, B, C and D, in theoretical instruction are given.

The practical work of the department applies to the general student body. A careful medical examination, including a thorough test of the sight, is made of all men coming under the regulations on entering college. A series of measurements is taken, particular stress being laid on those which can be changed by judicious exercise; while tests are made also of the strength of the legs, back and shoulders, chest, arms and forearms. On the basis of the information obtained at this examination the students are divided into three classes according to their physical condition. (*a*) Those who are below the normal are given special work to remedy or correct such defects as scoliosis, flat-foot, weak chest, round shoulders, etc., which are susceptible to improvement by prescribed gymnastic exercise. (*b*) For the average man a regular gymnastic course is given, beginning with light free-hand movements, and going forward by easy and progressive steps to the most advanced work on the whole range of gymnastic apparatus. (*c*) For men who are representing the University on the river or the athletic field, or who are trying for any of the teams or crews, credit is given on the basis of gymnastic work as specified in the Manual.

All candidates for teams or crews must pass a satisfactory medical examination by the Director before being considered eligible to represent the University.

Proficiency in swimming is required of all the candidates for crews, and is taught to all students of the first year.

# FINANCIAL OBLIGATIONS AND DORMITORIES.

## REGULATIONS GOVERNING PAYMENTS.

The following regulations governing the payment of fees, rents, charges, and deposits have been adopted by the Trustees of the University of Pennsylvania, subject to change at their discretion.

I. Entrance Examination Fees: A fee of five dollars shall be paid for each series of entrance examinations taken at the University; and an extra fee of five dollars shall be paid if the application for admission to the desired series of examinations is not filed in the Office of Admissions at least one week before the beginning of the series.

II. Late Application Fee: A fee of five dollars shall be paid by each applicant for admission to the Towne Scientific School if his application, together with the necessary credentials, has not been filed in the Office of Admissions at least two weeks before the opening day of the term during which the applicant desires to begin work at the University.

III. Matriculation Fee: A matriculation fee of five dollars shall be paid by every new student entering the University. If a student is transferred from one department to another a second matriculation fee shall not be paid.

IV. Tuition Fee: All fees for tuition, etc., are charged for the year and payable in two equal instalments. The first payment shall be made upon date of registration, and the second payment, which becomes due February first, shall be made within one week of that date.

V. Gymnasium and Houston Club Fee: This fee shall be paid by all students. Instruction in gymnastics, free use of the gymnasium apparatus and pool, and full membership privileges in the Houston Club are covered by this fee, which is payable in two equal instalments when tuition fees are due. The annual fee of ten dollars is divided as follows: Gymnasium, $7.00; Houston Club, $3.00.

VI. Late Registration Fee: Students who fail to register, or to complete registration by the satisfaction of all term obligations at the Bursar's Office, within two weeks after the opening day of either term of the University, shall be required to pay an additional fee of five dollars ($5.00) for late registration.

VII. Dormitory Rents and Charges: Rents are due and payable one-half October 1 and one-half February 1. If the lease is signed after October 1, the first half is due when the lease is signed, and the second half is due February 1. If signed after February 1, the entire rent is due when the lease is signed. Charges are due as they are incurred.

VIII. Graduation Fees: Graduation and certificate fees are due May 15.

IX. Deposits: Every student shall, upon entering the University, make a deposit of an amount required in the course in which he registers, to cover loss, damage, or breakage of University property, library fines, or any charge not paid by the student in some other way. A student whose deposit is by charges against it reduced to one-half its original amount or less shall be required to pay a sum sufficient to restore the deposit to the original amount. A student entering another class or department shall make up his deposit to the amount required in that class or department, if the amount be larger, or may reduce his deposit if the amount be smaller. No deposit or balance remaining on a deposit shall be finally repaid to a student until he shall have been graduated, or shall have formally withdrawn from the University.

## FAILURE TO PAY.

If a student fails to pay his fees and other charges in accordance with the above regulations, his name is dropped from the University rolls and he is excluded from all work until payment is made. The student will be held accountable for all absences incurred through the operation of this rule. If payment in full is not made within three weeks of the date upon which the charges become due, the student will be dropped from his class.

## WITHDRAWALS, ALLOWANCES AND SPECIAL RULES.

Withdrawal: *Separate written notice must in all cases be given to the Dean and the Bursar at the time of withdrawal* if a student wishes to secure any of the allowances granted in special cases, as follows:

(1) A student who withdraws within one week of the date on which he registered may receive a return of the full amount of the tuition paid, but in no case will the matriculation fee be returned.

(2) A student who leaves the University for any cause, after the first week and within thirty days from the beginning of either the first or second term, will be entitled to a return of one-half of the term's fees.

(3) A student who, on account of illness or other physical disability, withdraws during the term will be entitled to a return of an amount which shall be such proportionate part of the entire tuition fee as the number of weeks in which he is not in attendance bears to the number of weeks in the academic session, provided such proportionate part be not more than one-half of the term's fees.

(4) A student who withdraws after November 1, or March 10, of any year, for causes other than illness or physical disability, will be given no reduction in the term's fee.

Withdrawal from the University does not cancel a Dormitory lease. Whenever possible, a room given up will be re-rented, and a charge made only for that period in which the room is held in the lessee's name. Should no subsequent tenant be found, the lessee will be held responsible for the full year's rental.

Leave of Absence: The Dean may, for good cause, grant a leave of absence to a student in good standing. No fees will be returned in such cases, but an allowance will be made upon the fees when the student re-enters the course, proportionate to the unexpired period of the session in which leave of absence was granted.

Repeating a Year: A student who does not complete the work for a degree or certificate within the time indicated for the course shall in any succeeding year or years pay tuition for all subjects then or previously repeated in class, provided that in no year shall the fee so paid exceed the regular fee for the course.

Credit for Advance Standing: A student who enters any department, or who is transferred from one department to another, with advance standing, will be given financial credit for all subjects in which advance standing is given, provided that, if the student takes more than the minimum amount of work required for a degree or certificate, or repeats any subjects in class, the fee for the subjects so taken in excess or repeated shall be deducted before the allowance is made.

A student, pursuing work in the Summer School of the University for which advance credit toward a degree or certificate is given, will be given financial credit for all subjects in which advance credit is given.

Special Students: Special students will pay the full tuition fee of regular students.

Changing Courses: A student who is transferred during the year from one department to another shall pay in each department a fee proportionate to the length of attendance.

Late Registration and Absence: Neither late registration nor absence during the term shall entitle the student to a reduction in fees, except where the student signifies in writing his intention not to take examinations or claim credit for the term's work.

Right to Withdraw or Graduate: No student shall be granted a certificate of withdrawal or be graduated who has not paid in full all his financial obligations to the University.

## PAYMENTS—CASHING STUDENTS' DRAFTS.

Payments due the University must be made in cash, or by cheque, bank draft, or postal money order, drawn for the exact amount due.

As an accommodation to students, the Bursar will cash at his office, 102 College Hall, bank drafts on Philadelphia or New York, and postal money orders, for not more than $150.00.

## DORMITORIES.

The dormitory buildings are in one continuous group surrounding two open courts; the most recent buildings are on two sides of what will in time be a third enclosed court. Lists of vacant rooms, prices and other information will be furnished by the Bursar of the University, Room 102, College Hall.

Rooms are of five classes, viz.: *triple suites,* consisting of bedrooms and study for three students; *double suites,* consisting each of two bedrooms and one study, for two students; *single suites,* consisting each of one study and one bedroom for one student; *double rooms,* which are large single apartments furnished for two students; and *single rooms,* of various sizes, each furnished for one student.

All rooms and halls are heated by steam and lighted by electricity. The buildings are on the "separate staircase" system, all doors opening into the courts. On every staircase, and (in nearly all the houses) on each floor, are lavatories, with hot and cold shower-baths, etc. Almost all the suites and double rooms, and many of the single rooms have open fireplaces. The University supplies for each student the following furniture: a single bedstead, mattress, bureau, washstand, table, bookcase, chairs and toilet china.

Dormitory rooms may be engaged by present students in any department of the University, or by those intending to be students during the coming year, upon either of the following conditions:

(*a*) By paying in advance the full year's rental for the room desired, plus a deposit of ten dollars ($10.00) to cover possible damage, any balance remaining to be returned when the room is finally given up.

(*b*) By filing with the application for a room a bond securing the full amount of the rent and charges; the printed form of the bond may be had upon application to the Bursar. When two students wish to occupy a room together, each must file a bond. The bond must be signed by two responsible property owners, of whom one must be a citizen of the United States. No student or officer of the University will be accepted as bondsman. The bond may not be signed by a married woman whose husband is living, and it is preferred that both sureties should be men.

Every student not previously a resident in the dormitories who files a bond with his application shall be required upon the signing of his lease to pay ten dollars ($10.00). Twenty dollars ($20.00) shall be paid by a student who alone leases a double room or double suite. This payment shall apply as a part payment on the first term's rent. In case the lessee desires to give up his room on or before the opening day of the University, he may do so by notifying the Bursar in writing, and the bondsmen shall thereupon be released from further liability for the rental of the room, but the payment made at the signing of the lease shall be forfeited. A similar forfeit shall be deducted when a student who had engaged his room by making the full payment of rental and deposit in advance, as specified above, desires to give up his room. The balance due shall thereupon be returned to him.

Rents are payable in advance in two equal instalments, due October 1 and February 1, respectively. (For rules regulating payments see "Regulations Governing Payments.")

Beginning with the session of 1919-1920, all matriculates in the Freshman Class of the Towne Scientific School who do not reside at home, will be required to live in the University Dormitories, unless excused for cause. Freshmen who may have completed a full year's work at another recognized college will be excused upon request. The houses enclosing the Big Quad, excepting Graduate House, have been set aside as Freshman Dormitories, and assignments will be made to prospective residents as soon as they have been certified by the Director of Admissions as eligible.

A room may not be leased in the spring, held until the fall, and transferred at that time to another student. If the room is to be re-assigned, it must be offered to those on the "waiting list" for dormitory rooms at that time.

Rooms not leased for 1919-20 by present occupants will be assigned by lot. A list of the rooms to be assigned may be had on application. Applications from present students of the University in any department, or from those intending to be students during the year 1919-20, will be received until noon on April 21, 1919. Assignments will be made by lot. When the name of an applicant is drawn the *first* number on his list will, if possible, be assigned to him. But if that is already taken, the *second* number on his list will be assigned, if possible, and so on.

Assignments will be announced on April 22. Leases must be signed and the initial payment mentioned above must be made on May 3, 1919.

Any rooms remaining unassigned on April 22 will be assigned in the order in which applications are received. When all the rooms have been assigned the Bursar will receive applications for places on the "waiting list." Rooms thrown open for re-assignment will be offered first to those on this list. All tenants must complete registration and show matriculation cards for the year 1919-20 at the dormitory office by October 3, 1919.

Attention is called to the following regulation of the Board of Deans with regard to the occupation of dormitory rooms by special and partial students:

"Except by special permission of the Provost, no special or partial student may be assigned to a room in the dormitories unless he is taking in the University 50 per cent. of the number of hours a week required of regular students in the department in which he is registered. When, however, the number of hours a week required of regular students in the department varies as between two or more classes, the hours required of a special or partial student to entitle him to be assigned to a room will be calculated upon the basis of hours required of regular students in that class in his department which is required to take the greatest number of hours a week.

"A student who holds a dormitory room loses his right to such room (1) when he ceases to be a student in any department of the University; (2) when he seriously infringes the rules regulating his conduct in the dormitories; (3) when being a regular student, he becomes a special or partial student taking less than the number of hours required of such students as stated above; or, when, being a special or partial student, he ceases to take the number of hours required of such student as above stated; and, (4) when he or his room-mate ceases to occupy the room regularly."

In the assignment of a suite or double room, preference will be given to an application signed by two students who will use the room together. Two students wishing to apply for a room together should both sign an application for the room; such an application will be given two chances in the allotment, and any room drawn will be assigned to both the applicants. The University, however, reserves the right to cancel any assignment of a room if it is not duly claimed and occupied throughout the year by the student or students signing the application. Suspension or expulsion from the University, or serious infringement of the rules, will be considered sufficient grounds for the cancellation by the University of any lease. Subletting or exchange of rooms is not permitted. Voluntary withdrawal from the University does not in itself cancel a lease. The student who wishes to withdraw after the opening day of the University should apply to the Bursar for the terms upon which his lease may be cancelled. The tenant is held for the full year's rent and charges; but when the room is vacated before the end of the college year, the bondsman shall not be held responsible for the rent of the room for the rest of the year if the room is rented to another tenant.

If one of two room-mates is expelled or suspended, or so infringes University rules as to make his removal from the dormitories necessary, the other room-mate may have the room assigned to him by immediately signing a new application; provided that there are not two other students applying together for the room. Or he may hold the room by taking another room-mate, who must be qualified by filing an application and bond. If he fails to hold the room in one of these two ways the University may, after giving him notice, require him to vacate the room.

Rentals are for the full college year: that is, from the Saturday before the opening of the University to the Saturday after Commencement Day, inclusive. Occupancy of rooms during any time not included within the regular lease must be paid for as an extra charge. Rents include heat and all reasonable care of rooms, and also light, except in the Memorial Tower, Bodine, Robert Morris, and all houses east of Memorial Tower, in which the rooms are supplied with meters, tenants being charged according to the amount of light used. Additional service in the care of rooms must be paid for as extra, and must, in all cases, be performed by persons authorized by the University. Cooking of food in the rooms is strictly prohibited.

The Parietal Committee, appointed by the Trustees to have charge of the discipline of the dormitories, consists of the five Proctors, resident in the dormitories, and one other person, appointed by the Provost. The students in each house of the dormitories elect one of their number as a Representative, and these Representatives form a Board which meets regularly and acts with the Parietal Committee.

## UNIVERSITY COMMITTEE ON STUDENTS' RESIDENCES.

The University reserves the right to refuse permission to students to reside in any house not approved by the University Committee on Students' Residences.

UNIVERSITY OF ILLINOIS-URBANA

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